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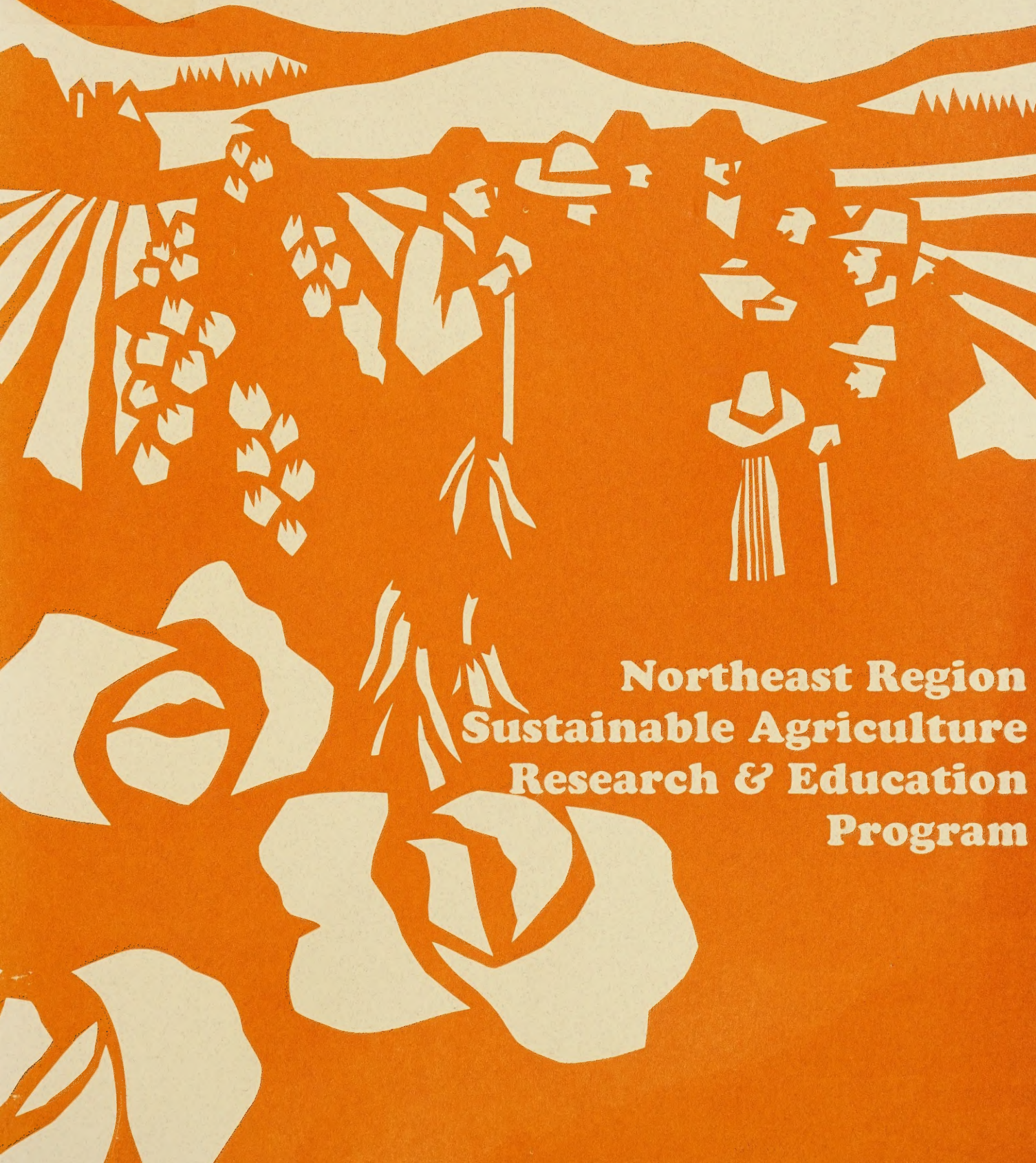
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1999

Progress Report



**Northeast Region
Sustainable Agriculture
Research & Education
Program**

Northeast Region
SARE

Sustainable Agriculture
Research & Education Program

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June 1999

Dear Friends of Northeast SARE:

Enclosed is your 1999 Progress Report, which we hope will be useful for both reference and general reading. You will see it has been a productive and busy year.

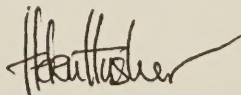
Last year's survey indicates that most of you rely on the progress report for background and contact information about projects, and that the report is handed around to colleagues, students, and other producers. This is as it should be, and we hope you will call or write for another copy if yours gets lost or dirty.

We got several positive comments from the survey about the clarity of the layout, and we tried this year to make a good thing even better. We also expanded the index and the space allotted to Farmer Grant summaries, and we hope you will let us know if these are genuine improvements.

Please feel free to call, write, or e-mail if you have any comments or concerns about the 1999 Progress Report, or if you know of someone who could make good use of a copy.

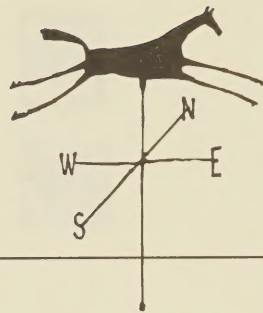
Thank you also for your support of Northeast SARE.

Yours,



Helen Husher
Writer/Editor

SARE: An Overview



The USDA Sustainable Agriculture Research and Education (SARE) program is a federal competitive grants program with regional leadership and decision making. SARE's mission is to increase knowledge that helps farmers adopt production and marketing practices that are profitable, environmentally sound, and beneficial to local communities and society in general.

To accomplish these goals, the program places special emphasis on whole-farm systems research, including the profitability of alternative production and marketing methods. The program also funds experimental component research, exploratory research, demonstrations, educational projects, and in-service or professional development projects. SARE funds the work of scientists, producers, educators, and private sector representatives.

Authorized by the 1985 and 1990 Farm Bills, SARE was first funded in 1988. Since then, more than \$90 million funneled to SARE has supported more than 1,200 projects.

SARE is administered through the USDA Cooperative Research, Education, and Extension Service. Nationally, the 1999 allocation was about \$11 million.

The Northeast SARE region includes Connecticut, Delaware, Maine, Massachusetts, Maryland, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, West Virginia, Vermont, and Washington, D.C.

The United States Department of Agriculture (USDA) prohibits discrimination in its programs on the basis of race, color, national origin, sex, religion, age, disability, political beliefs, and marital or family status. Not all prohibited bases apply to all programs.

People with disabilities requiring alternative means for communication with the program should contact the USDA Office of Communications at 201-720-5881 (voice) or 202-720-7808 (TDD).

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Vegetables

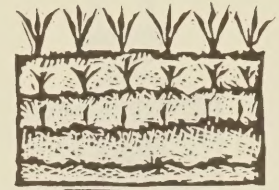
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Northeast Region SARE Mission

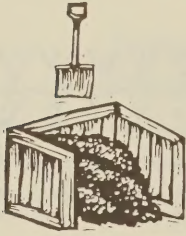
Our mission is to help develop and maintain diversified agricultural and forestry systems that enhance the economic, environmental and social health of the Northeast for present and future generations. Our work will support production, processing and marketing systems that sustain rural communities, and support agricultural activities in the region's rural, urban and suburban areas.

Sustainable agricultural and forestry systems will:

- ◆ promote good stewardship of the land by utilizing production techniques and land management practices that prevent erosion, improve soil health and minimize water and air pollution.
- ◆ promote nutrient cycling through profitable use of agricultural byproducts and wastes;
- ◆ rely on — and encourage — greater diversity among farms, and on individual farms, as well as more management-intensive practices that are safe and environmentally sound;
- ◆ profitably employ more people in agricultural enterprises, both in full- and part-time capacities;
- ◆ contribute to the quality of life for producers, communities, and society as a whole.

Our research, education, and on-farm demonstration efforts will:

- ◆ advance knowledge about and dissemination of conceptual, practical, and scientific information needed by producers, marketers, farm advisors, processors, and planners to adopt more sustainable practices;
- ◆ encourage farm and non-farm citizens in a process of discovery and learning that will support a more sustainable agricultural system;
- ◆ foster greater cooperation among farmers and new and strengthened partnerships between farmers, consumers, environmentalists, scientists, educators, government, and agribusinesses;
- ◆ encourage an infrastructure for food processing and distribution that focuses on regional markets, strategically uses national and global markets, and enables producers to receive economic benefits from “value-added” products;
- ◆ improve public understanding of the region's agriculture base, farming, farm products, policies, and programs that are conducive to sustainable agricultural systems.



How To Use this Report

There are three distinct grant programs under the SARE umbrella—**research and education**, **professional development**, and **farmer grants**. In this book, the research and education grants are clustered by their main area of inquiry—vegetables, bees, urban-farm connections, fruit, and so on. There are eleven categories, but we still struggle every year to put projects unambiguously in a particular place. The interdisciplinary quality of many SARE projects means that some reports could appear in more than one category, while others sometimes seem to be in a category of their own. Life is not perfect, which is why there is also an index.

Professional development grants are all together in the professional development portion of the book, which starts on page 129; **farmer grant** summaries start on page 205.

Toward the back, you will also find information about the regional leadership structure, specifically rosters of the **advisory council**, **technical committee**, and **PDP coordinators**. There is also a resource section that describes regional and national **resources**—books, bulletins, videos, and other tools—developed through SARE-supported initiatives.

A Few Key Terms

As you read, you will encounter **final reports**, **annual reports**, and **new project descriptions**. Final reports are normally longer than average, and summarize the results of a completed project. Annual reports describe the outcomes or the progress of a project over the past year. New project descriptions are exactly that—descriptions of the plan of work for projects that were funded during 1998.

Coordinators are the people responsible for overseeing and reporting a given initiative; **collaborators** are the other project participants who bring both expertise and, sometimes, matching funds. If you want to get in touch with someone associated with the project, you can call, write, or e-mail the **coordinator**.



All Those Letters

The large **capital letters** on the lower part of the first page of each report indicate the **states** included in the project—we used standard postal service abbreviations. If all the states in the region were involved, we say so, and thus avoid listing all thirteen states in the region.

As much as possible, we have tried to avoid having the reports turn into alphabet soup, but some acronyms are inevitable. **USDA** stands for the United States Department of Agriculture; **ARS** is the USDA Agricultural Research Service. The **EPA** is the Environmental Protection Agency; **SAN** stands for the Sustainable Agriculture Network, the outreach arm of **SARE**. Other acronyms in reports are spelled out on the first reference, just to clarify what the letters really mean.

Numbers, Too

The **project number**, also included on the first page and in the outside column of each subsequent page, is **the number assigned at the Northeast SARE office** to help us track projects. It is useful mainly if you want to find out more about an individual project—we will find materials for you much faster if you give us this number instead of a description of the project itself. Projects with an **E** prefix on the project number are professional development efforts; projects with an **L** prefix are research and education efforts; projects with an **F** prefix are farmer grants.



Northeast SARE Professional Development Program

The Whole Farm, the Whole Community

How useful you may be in a particular line of work depends on whether you keep your ideas wider than your specialty.

—Cleo Craig, president of AT&T
Commencement address, University of Missouri

by Herb Cole

During 1998, the Professional Development Program, or PDP, broadened its perspective by adding four new members to its coordinating committee—Jon Danko is an organic grain farmer in Delaware; Lisa Krall is a USDA NRCS sustainable ag agronomist based in Maine; Russ Libby is the executive director of the Maine Organic Farmers Association; and Lorraine Merrill is a New Hampshire dairy farmer and journalist.

This committee works on leadership, operational, and program development issues, which are all key in a program that offers innovative continuing education to Cooperative Extension personnel. During the past year, the group convened to educate and encourage each other and to explore how the PDP program output could be increased in our home states. We shared information about successes and failures, explored how to broaden partnerships among agencies and nonprofits, and set priorities for future funding.

We also went on farm tours as part of the joint SARE administrative council and coordinating committee summer meeting in Portland, Maine. These tours let the state coordinators observe, interact with, and learn from farmers in another state, as well as share ideas with administrative council members. As a result of the summer meeting, the state coordinators made it a priority to increase the awareness and interest of farmers in submitting producer grants. This program emphasis paid off—146 producer grant applications were submitted in 1998, the largest number ever. Better still, the quality of the proposals was high.

The Invisible Hand

One of the major goals of Northeast SARE is to move beyond being a grants program and to move toward making significant impact on sustaining the farms and communities of the region. This means bringing the research and education and professional development components together. Even though our funding authorization clearly delineates two programs, the lines between them should be almost invisible in the conduct of our programs.

This is why most aspects of our professional development training should be planned *with farmers and for farmers*, keeping in mind that the ultimate user *is the farmer*. From planning to implementation, the farmer must be involved. Farmers and farming do not exist in isolation or only in the company of other farmers—instead, the agricultural community involves lenders, service firms, state departments of agriculture, USDA NRCS and FSA, and farm organizations, as well as extension educators. All must be knowledgeable and committed to sustainable agriculture principles and practice; for agriculture to have a future, com-

munities must support farms and farming.

Out of this commitment to farms and their communities, the administrative council funded an initiative, under the leadership of the Center for Sustainable Agriculture at the University of Vermont, for multi-state, comprehensive training in sustainable agriculture. The plan is to increase understanding of sustainable agriculture systems, and to develop the tools and the leadership to increase the sustainability of farms and their communities.

A Healthy Farm A Healthy Farm Economy

Another initiative has been to identify and address the attributes of a healthy farm. The goal here has been to develop the teachers and trainers who can help farmers and community leaders create a mosaic of sustainable farms and communities across the region. As a result of administrative council deliberations in January 1998, and followup PDP state coordinator discussions throughout the spring and summer, a conceptual framework was created that describes most of the attributes of a sustainable healthy farm. We agreed that our professional development efforts should address as many of these parameters as possible as we seek to sustain agriculture in the northeast region.

For the present, and certainly for the near future, economic sustainability will be the dominant concern in sustaining farms and farming. Two major issues are confronting every farmer throughout the Northeast—return on investment to allow for the retirement of debt, and return on labor and management to provide for family living. These two factors affect immediate sustainability. A third factor—return on capital invested in land and physical facilities—dictates long-term sustainability, and es-

pecially affects whether a farm can be sold as a farm or transferred to the next generation as a farm. Economic sustainability must be incorporated into all aspects of our PDP efforts.

Beyond the First Decade

As SARE and the PDP program move into their second decade, the understanding of farm health, farming communities, and the dynamics of agricultural sustainability will almost certainly season and improve, so that we will know more about sustainable farming in 2009 than we can probably imagine in 1999. Provided, of course, we keep our ideas wider than our specialties—much of the success of PDP efforts rests on the commitment and diversity of its leadership and on a willingness to broaden the discussion.

A listing of the Professional Development Program state coordinators is on page 222, and the section on professional development activities begins on page 129.

Herb Cole is the coordinator of the Northeast SARE Professional Development Program, and he can be reached at 814-863-7235.



**Training
planned with
farmers and
for farmers,
keeping in
mind that the
ultimate user
is the farmer**





agronomy

Promoting Agricultural Sustainability Through the Use of Rhizosphere-Competent Fungi as an Alternative to Soil Fungicide



Summary

This research determined that growers can effectively use a recently developed biocontrol fungus, *Trichoderma harzianum* 1295-22. This strain is derived from a common rhizosphere inhabitant, and was bred at Cornell University for its ability to better colonize roots and kill root pathogens. It is commercially available under the name T-22. Using sweet corn as a model, researchers examined five parameters—financial return, application method, interaction with cover crop, soil type, and soil temperature—that growers are concerned about.

The potential result of these findings will be higher production (estimated at 5%) with all other inputs remaining the same. This increase is about a fiftyfold return on investment for the farmer. The research is developing delivery systems that are usable by family farmers and small producers. T-22 application qualifies as organic management, permitting added value for those specialized markets.

Objectives

- ◆ Evaluate delivery methods for *Trichoderma harzianum* strain 1295-22 to find which is most effective in commercial farming operations. The methods are in-furrow application, seed treatment, and cover-crop inoculum.
- ◆ Evaluate the economic impact of different delivery systems.
- ◆ Test additional cover crops for effectiveness in increasing the population of the biocontrol organism so that a broader choice of delivery systems might be identified.
- ◆ Identify the properties of Northeastern agricultural soils that affect the ability of *Trichoderma* to colonize crop roots, thereby identifying the most promising places to begin implementation.
- ◆ Identify growth-reducing stresses that are mitigated by *Trichoderma*.

Key Findings

Using *Trichoderma* is profitable. The cost is low; the risk is small. The return averages 15 to 30 times the cost.

Trichoderma can be considered biological insurance against unpredictable crop loss. T-22 preserves the crop's yield potential under certain adverse conditions.

Mixing *Trichoderma* in the planter box works best because it provides a highly vigorous inoculum in close contact with the seed. Pretreated seed should be effective when it becomes available.

Colonized cover crops are not an effective way to inoculate sweet corn with *Trichoderma*. Colonization was good on all soils suitable for sweet corn, but liming acid soils could improve colonization.

Trichoderma is effective when the daytime soil temperature is above 55°F. Colder soil restricts *Trichoderma* growth and favors pathogens.

If seed-applied fungicides are necessary for stand establishment, they need to be used regardless of whether *Trichoderma* is also used.

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Collaborators

Cornell University and Cooperative
Extension
Rodale Institute
New York farmers

SARE Grant

\$123,801

Match

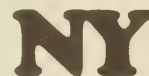
\$147,474

Duration

1994 to 1998

Project number

LNE94-43



Methods and Findings

This research has, as a broad objective, to determine what growers need to know to effectively use *Trichoderma harzianum* 1295-22. The results are also available on a web site at <http://www.nysaes.cornell.edu/hort/faculty/bjorkman/>. Follow the link "Implementation of *Trichoderma*."

Better root growth of *Trichoderma*-colonized roots should allow the plant to capture soluble nitrogen and phosphorous that would otherwise leach to the ground water, thus preventing a process that is both wasteful of resources and detrimental to water quality. In addition, use of a biocontrol fungus is one more element that will increase farmer awareness of the active management of soil microflora, an awareness that will lead to better management of soil health.

One goal of this project is to reduce the need for fungicides used as treatments on seeds. Our experiments showed that routine fungicide treatments were not necessary in warm soils.

The preferred application method for sweet corn is a powder that is mixed with the seeds in the planter box at sowing. Seed coating produces excellent colonization as well, and commercial seed treatment may be commercially available in the near future. The response to seeds purchased with the seed treatment already applied should be similar to that described in this research.

The product is inexpensive to use on corn because of the small amount of inoculum necessary. The return on investment was ten- to fortyfold on sweet corn, depending on the market.

The soil requirements for colonization were studied in experiments done at twelve different field sites in 1996 and seven sites in 1997, with twelve additional soils in a common garden each year. These showed that all tested soil types supported high populations of *Trichoderma* on roots inoculated with T-22. Wild *Trichoderma* have much lower populations and are more sensitive to soil type. An analysis of soil characteristics that are associated with good colonization confirmed previous findings that roots growing in soils high in calcium are better colonized.

The minimum useful temperature for *Trichoderma* was lower than expected. There was no problem at 55°F or above. In very early plantings, one each in 1995 and 1997, colonization was somewhat reduced as a result of cold. Even though the

growth of T-22 was slower, its value in ameliorating stress is higher in cold soil. Although overwintered or early-spring crops may give unsatisfactory colonization, T-22 is useful at any temperature appropriate for sowing sweet corn.

Research on this and other crops has shown a clear pattern of what to expect from *Trichoderma*. The yield enhancement is primarily seen when plants in a well-managed soil are weakened by stress. *Trichoderma* restores their original vigor.

The yield-reducing conditions encountered in this study were water stress, early planting or harvest, moderate nitrogen fertilizer, and low plant population. In all these situations, greater root growth has obvious value. However, *Trichoderma* did not work if the field was flooded or crusted because both roots and fungi need air to grow. The restorative effect occurs when control yields are reduced below a threshold amount. It occurred when untreated sweet corn yielded less than five tons an acre. Near the threshold yield, the increase was about 10%; with greater stress *Trichoderma* increased yields by 50% to 100%.

Delivery Methods

Treating seed with a slurry of spores places the spores in direct contact with the seed, but this placement also means that the spores are in contact with fungicide and stickers on treated seed. Extended exposure to these materials may kill or inhibit the beneficial fungus. T-22 treatments were tested with several combinations of the fungicides Apron, Captan, Demosan and Imazilil. T-22 was compatible with all except Imazilil, which is used to protect against *Penicillium*. Since *Penicillium* is such an important seedling disease of sweet corn, we also investigated compatibility with one substitute for Imazilil called Maxim. This fungicide was completely compatible with T-22.

In three field trials, we tested the ability of an uninoculated sweet corn crop to be colonized by *Trichoderma* when it followed inoculated winter rye that had been plowed down before sowing the sweet corn. At all three farms, no *Trichoderma* colonized the subsequent corn crop. Do not expect *Trichoderma* to colonize crops that follow the crop that was inoculated with T-22.

Economic Impact

T-22 had a positive economic impact by increas-

ing yields. The effect of *Trichoderma* was pronounced where untreated plots had low yields. The yields were low at these sites because of intentional management practices to get a particular market, such as early planting, premature harvest, or organic nitrogen management. None were low due to poor management. In 1995 and 1997, both dry growing seasons, the response to *Trichoderma* was seen where control yields were below five to six tons, whereas in 1996 the threshold was around four tons. In dry years, root development, which is often increased by *Trichoderma*, is more limiting to growth. The wet season in 1996 allowed even crops with minimal root systems to grow well.

The economic return was substantial. The average return paid for the treatment many times over, on sweet corn and on other crops. Therefore the economic risk of using T-22 is minimal. Also, the maximum benefit comes when most needed by the farmer. When conditions arise during the season that compromise the yield and result in a low-income year, the response to T-22 is greatest. This effect could help manage economic risk in addition to having an overall positive return.

The estimated cost to use the different formulations of T-22 on sweet corn are: granules—\$10 to \$30 an acre; planter box—\$1.17 to \$1.50 an acre; seed treatment—\$5 to 10 an acre. The return was established only for planter box. The return for seed treatment should be similar, while granules would probably be somewhat less. The average return for fresh market sweet corn was \$50 an acre, and the average return for processing sweet corn was \$17 an acre.

Additional Cover Crops

Cover crops may differ in their ability to support a population of *Trichoderma* that is sufficient for colonizing a subsequent crop. The colonization of *Trichoderma* on several species used as cover crops was examined in greenhouse trials. Six cover crops of regional significance were selected: annual ryegrass, canola, red clover, grain rye, hairy vetch, and winter wheat.

These results suggest wheat as the most likely cover crop to use for carrying over and multiplying *Trichoderma* inoculum, with canola the likely second. We are not especially optimistic about any of them in light of the field results.

Soil Characteristics

In order to identify specific traits of soils that are important to colonization, a variety of soils were tested in a common-garden experiment. This experiment was conducted in all three seasons.

We concluded T-22 will colonize sweet corn on a great diversity of soils. The only northeastern soils where there would be a concern are those very low in calcium and acidic. Liming in accord with normal recommendations for sweet corn should eliminate even the small chance of inadequate colonization.

During the common-garden experiment, we also examined whether different types of soil management alter the ability of *Trichoderma* to colonize. Of specific interest is whether organic matter management that promotes growth of a diverse soil microflora will make it more difficult for *Trichoderma* to invade.

Stable microbial communities will not prevent colonization by *Trichoderma*. This organism may be effectively used by organic growers.

The performance of *Trichoderma* on different soils was tested with grower trials. Sweet corn is colonized on a wide variety of soil types. Soil type does not need to be a consideration in deciding whether to use *Trichoderma*.

While we cannot distinguish wild strains from strain 22 in the assay, other tests have shown that strain 22 displaces the wild ones on inoculated roots. Even when the wild strains reach high populations, they are less effective at protecting from disease or increasing growth. They also do not colonize the roots as quickly when the seed germinates. These are the traits that were bred into strain 22 that sets it apart from the wild strains.

Stresses

Cold. *Trichoderma* grows sparingly below 60°F and not at all below 50°F. This may limit colonization immediately upon germination. Super-sweet corn also does not germinate at low temperatures, so the germination of both may only be delayed by cold. Colonization of roots was strong at the four-leaf stage regardless of the soil temperature. Early colonization was affected by low temperature, confirming the slow growth of *Trichoderma* in cool soil.

These data are the first strong field evidence of the remarkable rhizosphere competence of T-22.

Project number

LNE94-43

No other biological on the market has a comparable ability to colonize roots under field conditions.

Oxidation. Treatment of the seeds with dilute hypochlorite to cause oxidation injury resulted in considerably reduced vigor. Subsequent colonization with *Trichoderma* completely restored the vigor of these seedlings. The effect of both hypochlorite and *Trichoderma* treatment on seedling vigor occurred mainly in the moderately vigorous seedlings. In contrast, the strongest seedlings in each group performed similarly.

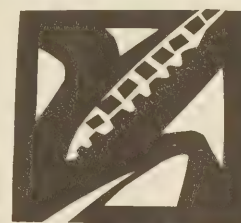
Allelopathy. Soil treated with the allelopathic compound benzoxazolinone (BOA) resulted in truncated roots with the same biomass as roots

grown in the absence of BOA. *Trichoderma* increased the biomass growth (dry-weight gain) by 52%, with no BOA effect.

Fungicides. Seed-applied fungicides, particularly Imazilil, represent a stress that can potentially diminish the effectiveness of the beneficial fungus. Seed-applied fungicides are often used in conjunction with T-22 to control seed rots, which are not affected by T-22. The effect of fungicide seed treatment on colonization and establishment was tested with the granule formulation in 1995. We found *Trichoderma* colonization was unaffected by the fungicides and fungicides were sometimes necessary for establishment, and *Trichoderma* did not substitute.

Reported March 1998

Soil Test for Active Organic Matter: A Tool to Help Assess Soil Quality



Summary

Sustaining soil quality is a fundamental facet of sustainable agriculture, and farmers need a practical tool for assessing the quality of their soils. This project integrates key chemical, physical, and biological soil measurements, as well as farmers' experience, into a working soil quality index (SQI) that is sensitive to agronomic management. This SQI will be used to evaluate various organic matter analytical procedures with the goal of developing a rapid, easy-to-use soil test for active carbon (C) that correlates with the SQI. This test will help farmers target the fields where sustainable organic matter management practices have the greatest potential to improve yield, production stability, and profits.

Objectives

- ◆ Integrate key chemical, physical and biological soil properties into a working soil quality index (SQI) that rates soil function and reflects the impacts of soil management.
- ◆ Document farmers' judgments of soil quality and use these to evaluate the SQI.
- ◆ Develop a quick test for active soil C that correlates well with the SQI.
- ◆ Refine the active C soil test to optimize convenience without sacrificing accuracy.
- ◆ Predict where improved organic matter management will increase crop yields.
- ◆ Educate agriculturalists and policy makers about uses and limitations of an active C soil test.

Methods and Findings

Soil quality (SQ), like air and water quality, is a major goal of natural resource management. Although some resource-inventory approaches to soil quality focus on permanent soil properties, our dynamic concept of SQ emphasizes soil properties that can be affected by management practices. Most of the functions associated with soil quality are influenced by soil organic matter, especially the small portion that is termed active organic C. The SQI we develop will be used to predict crop response to improved soil organic matter management.

In the fall of 1997, we sampled soils from 18 mid-Atlantic farms. On each farm we sampled one or more paired sites (low and high quality) that the farmer had selected. The farmers were interviewed about the indicators they used in judging soil quality and the practices they use for managing soil quality. Samples were also collected from replicated experimental plots in the five ongoing cropping systems studies that we had sampled in the spring of 1997.

The soil samples were analyzed for microbial biomass, microbial activity, active carbon, and aggregate stability. A new, improved, and inexpensive method for measuring aggregate stability was developed and compared to a standard method. These parameters were then integrated into two types of SQIs.

A number of potential active C tests were also performed on the soils. These measured the total carbon, sugars, and sugar-like compounds released by irradiation of the soil in a microwave oven. Both the active C-test results and the calculated SQIs were evaluated for their agreement with farmer judgments of soil quality and their sensitivity to experimental effects.

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Collaborators

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Delaware farmers
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SARE Grant

\$100,000

Match

\$139,000

Duration

1996 to 2001

Project number

LNE-96-69

MD
DE

In the first year of the project, we identified 33 farmers who felt that their farms had areas of soil in relatively "good" and "poor" condition. After some preliminary analyses on samples taken after harvest in the fall of 1996, 29 pairs of suitable sites were identified on 24 farms representing a wide range of sizes (from 25 to 6,000 acres) and enterprise types. The farms were in Maryland, Delaware, Virginia, West Virginia, and Pennsylvania, so as to represent a wide range of soils, climate, and cropping systems. In the fall of 1997 we sampled 22 such pairs of sites on 18 farms, revisited some of the previously used farms, and added several new farms to the project.

The collaborating farmers believe the most common criteria indicating soil quality were crop yield, resistance to erosion, and water retention. Of the principal practices the farmers use to manage soil quality, cover crops, minimum tillage, animal manure, and perennial sod were the four most frequently mentioned.

In addition to sampling the farmer-designated sites, we also sampled plots from five ongoing replicated cropping systems experiments. We chose plots that had experienced crop and soil management practices that alter soil organic matter, tilth, nutrient cycling, and plant vigor. The treatments included tillage, rotations, organic amendments, and cover crops. Soil samples from all sites were subjected to standard soil lab analyses, including particle size distribution, total carbon and nitrogen, and standard University of Maryland Soil Test Lab analyses (pH, available Ca, Mg, K, and P).

Since the on-farm pairs of sites were expected to have similar types of soils, it is not surprising that the standard soil tests showed little or no consistent difference between the sites designated by farmers as "good" and "poor." On well-managed farms, it is unlikely that traditional soil test parameters will limit soil quality or crop yields. Nearly all such soils are now in the medium soil test range or better. The poor soils did have slightly lower values for available calcium and slightly higher values for percent clay, probably as a result of greater subsoil mixing in cases where the poor soils were more eroded.

In contrast, all the biophysical soil quality parameters showed highly significant differences between the farmer-designated good and poor soils. These parameters included total organic carbon, an aggregate stability index, a measure of total microbial biomass C (TMBC), substrate induced respira-

tion, and a measure of the active soil carbon fraction (sugars reactive with anthrone extracted after microwaving soil, ARC). TMBC and ARC were particularly sensitive indicators of differences between the good and poor soils in both spring and fall data sets. Apparently, many farmers have soils that are in poor condition not because of N-P-K deficiencies or acidity, but because of biophysical properties related to the management history of the soils.

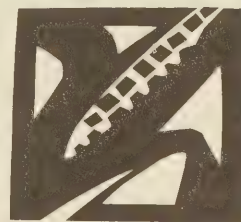
To improve our ability to diagnose the differences between good and poor soils, we calculated several types of SQIs. The purposes for determining the most effective SQI are twofold. First, the index may greatly increase the ability to interpret soil analyses in assessing soil quality, and second, the best index will be used to evaluate the active C soil tests to be developed during the later stages of this project. The amount of reducing sugars (by anthrone) extractable from soil after a microwave treatment has been predictive of the active C pool and reflects a wide range of soil-quality differences.

As a result of our work with a USDA-NRCS program to develop farmer-oriented, locally adapted, soil health scorecards, we learned that most farmers prefer to keep their subjective assessments qualitative rather than attach a score to them. Farmer assessments may be influenced by their observations of soil workability, crop appearance, ponding of rain water, and soil erosion.

We conducted a soil judging exercise aimed at determining if farmers can judge soil from farms unlike their own. From 80% to 100% of the farmers chose the correct soil in each soil pair examined. Soil scientists correctly identified the "good" soil from 36% to 93% of the time. We also analyzed soil from five replicated experiments to determine what soil properties are most affected by common management practices, and as a further test of the SQIs. The biophysical parameters differed among management treatments more in the longer-term experiments than in the more recent trials. The measures of active C and ANTC differentiated among soil management treatments better than total organic C. Not only were the probabilities of there being no difference very low, but these measures were in agreement with the farmer judgment in more than 90% of the cases.

Reported December 1998

Managed Riparian Buffers & Cover Crops to Minimize Phosphorus & Nitrogen Runoff Losses from Corn Fields



Summary

Phosphorus (P) and nitrogen (N) lost from silage cornfields are significant pollutants of surface waters in the Northeast. The goal of this project is to evaluate three field management alternatives to minimize runoff of P and N from cornfields into adjacent streams. We are comparing the effectiveness of riparian 25- to 50-foot wide buffer strips of grass-legume hay and a grass cover crop in corn. There is a control treatment of corn planted to the stream edge. All three alternatives offer an economic return to the farmer on land that would be unproductive if converted to a natural forest riparian zone, which is the recommended practice. Four small watersheds in a 15-acre field in Vermont's Champlain Valley were selected for study and fully instrumented to monitor runoff. Using a paired watershed design, we first calibrated the fields and then implemented the three management systems. We are currently comparing P and N runoff losses from the different treatments. Preliminary results for the first four months of the treatment period show reductions in runoff losses of both eroded sediment and P with implementation of buffer strips. Monitoring of treatment effects, including runoff losses, crop yields, and soil nutrient levels, will be continued through the 1999 season. The economic impact to the farmer of the management alternatives, including crop yields, will be evaluated and findings will be disseminated to farming and environmental groups through site visits and extension publications.

Objectives

- ◆ To evaluate the effectiveness of managed riparian zone or cover crop systems at reducing losses of P and N in surface runoff from silage cornfields, including an evaluation of the effect of riparian buffer width on pollutant abatement.
- ◆ To compare the relative importance of surface runoff, erosion and sediment deposition, and plant uptake on the loss of N and P from cornfields and on retention in managed riparian zones, and seasonal variations of these processes.
- ◆ To evaluate the economic impact of these management alternatives to the farmer.
- ◆ To distribute the results of this study, including both environmental and economic implications, to farmers and farm organizations, agricultural educators, agricultural and environmental agency personnel, industry representatives, and the general public via an extension and general outreach program.

Key Findings

This study has three phases: site selection and characterization, calibration, and treatment. Once the site was selected, the field was mapped at 30-cm contours to define the four separate surface drainage watersheds and to determine the location of flumes. Flumes to collect runoff and Coshocton wheels for flow-based sampling were installed in late 1995, and monitoring be-

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SARE Grant

\$142,448

Match

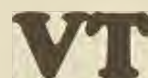
\$53,600

Duration

1997 to 2000

Project Number

LNE97-87



gan in 1996. Because of dry weather in 1996, only a limited number of samples were collected and the calibration period was extended through early spring of 1998.

The data from the calibration period were analyzed statistically to look for relationships among the four watersheds as required for the paired watershed design. This analysis showed that watersheds one, three, and four appear to behave similarly, at least in a statistical sense, with respect to runoff discharge, concentration, and sediment and nutrient export. While total phosphorus (TP), soluble reactive phosphorus (SRP), and total suspended solids (TSS) concentration and export were somewhat different in these three watersheds, the differences were not significant in the context of the large variability at this field scale. Watershed two, the largest, did tend to show significantly higher discharge, concentration, and export compared to the other three watersheds. These differences suggest that the behavior of watershed two is fundamentally different from that of the other three. While interesting, such differences are not impediments to the experiment, as the paired watershed approach is designed specifically to account for such differences.

Treatment Period

The treatment period began in the spring of 1998. The three buffer treatments—grass-legume hay 25 feet wide, grass-legume hay 50 feet wide, and corn with cover crop—as well as the silage corn control, were planted on June 12 by seeding a standard mix of red clover and cool-season grasses. The vegetation was well established, though seedlings were still quite small, on June 23, the date of a field tour. A few days later unusually heavy rains on two successive days, totaling almost four inches, caused erosive channeling in parts of the vegetative

buffers that required repair and reseeding. Additional extreme rainfall on July 9, August 11, and August 26 put additional stress on the buffer strips, but they held up well, requiring only minor reseeding. The late June storms caused severe erosion, especially in watershed two, where major gullies and standing water destroyed significant areas of the young corn crop. Massive deposits of eroded sediment were dumped in and in front of the flume of watershed two, making the flume inoperable for a time. Gullies and wet conditions made the field inaccessible for cultivation and interseeding for the next several weeks. We did seed annual ryegrass by hand in mid-July, but establishment was spotty. Because of the erosion damage and inadequate cover crop establishment, that treatment was eliminated from the experiment for the remainder of 1998. We will reevaluate the situation for 1999.

Runoff monitoring results were obtained for the other three treatments through mid-October, 1998. Note that these results are very preliminary and no statistical analysis has been conducted. However, beginning in late June, when buffer vegetation had become established, concentration values do cluster by treatment, with the 50-foot buffer the lowest, the 25-foot buffer next, and the control the highest. We calculated the total mass of P in runoff by multiplying P concentration by runoff volume. Two changes are apparent: first, loss of P in runoff increased dramatically as a result of unusual precipitation and runoff, and, second, a reduction in P loss attributable to the buffer strips, with the wider 50-foot strip being much more effective than the 25-foot strip. Results for total suspended solids show similar trends, reflecting the association of phosphorus with the sediment fraction of the runoff.

Reported December 1998



Demonstration of Narrow-Row Corn Production in New York

Summary

Three narrow-row corn silage experiments were evaluated on the dairy site at Table Rock Farms in Castile, New York. The three separate experiments, in which the participating farmer performed all field operations, evaluated narrow-row (15-inch row spacing) corn silage under high (harvest populations of 40,000 plants per acre and nitrogen rates derived from manure and the previous crop of 250 lbs of N per acre), and recommended inputs (harvest populations of 34,000 plants per acre and N rates derived from manure or residual from the previous year's fertilizer), as well as wide-row corn silage (30-inch row spacing) under recommended inputs. The three separate experiments, which averaged about ten acres each, followed alfalfa (first-year corn), corn (second-year corn from alfalfa) or corn (continuous corn).

Objectives

- ◆ To demonstrate to New York cash grain producers and dairy producers that narrow-row corn production is economically viable under New York growing conditions.
- ◆ To demonstrate to New York dairy producers that current recommended N rates and plant populations with reduced herbicide and insecticide rates are the most sustainable practices for narrow-row corn silage production.

Narrative

Final harvest populations of about 40,000 plants per acre in the high input and about 34,000 plants per acre in the recommended input treatments were achieved in all three experiments. The pre-sidedress soil nitrate test (PSNT) indicated high (>30 ppm) to very high (>35 ppm) soil nitrate concentrations in June in all three experiments. Whole-plant tissue analysis at the same time in June indicated very high nitrogen concentrations (>4.3%) in the corn plant at the early-vegetative (V6) development stage for all treatments. Likewise, at the silking period, ear-leaf N concentrations (>2.6%) indicated adequate N in the corn plant in all treatments. Although differences in PSNT values, whole-plant N, and ear-leaf N concentrations were not statistically significant, narrow-row corn under high inputs yielded greater (28 tons per acre) than narrow row (27.1 tons per acre) and wide-row corn (26.6 tons per acre) under recommended N inputs when averaged across the three experiments. At the time of this writing, corn silage quality (digestibility, fiber, and protein concentrations) and residual soil nitrogen concentrations had not yet been analyzed. Before any firm conclusions from the first year of this three-year experiment can be drawn, silage quality and residual soil nitrogen concentrations must be considered.

Two narrow-row grain corn experiments were evaluated at the corn grain site at the Primrose Farm in Cato, New York. Two separate experiments, in which the participating farmer performed all field operations, evaluated narrow-row corn under high (harvest populations of 33,000 plants per acre and N fertilizer rates of 150 lbs per acre), and wide- and narrow-row corn under recommended inputs (harvest populations of 27,000 plants per acre and 90 to 120

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SARE Grant

\$70,036

Match

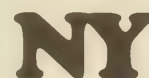
\$163,970

Duration

1997 to 2000

Project Number

LNE97-91



lbs of N per acre). The two separate experiments, which averaged about seven acres each, followed soybean (first-year corn) or corn (continuous corn). Unfortunately, harvest populations of only 23,000 to 26,000 plants per acre were achieved in the narrow- and wide-row treatments. The participating farmer used a zone tillage system, which may partially explain the less-than-targeted final populations in both experiments.

We did not do a PSNT for soil nitrate levels at early-vegetative development because the participating farmer applies all the N fertilizer at planting time. Nevertheless, whole-plant N concentrations during vegetative development in June indicated high N concentrations (>3.5%) in the plant for all treatments. Likewise, ear-leaf N concentrations at silking (2.40 to 2.67%) indicated adequate N concentrations for all treatments. Grain yields did not differ among the three treatments in the continuous corn experiment, with narrow-row corn yielding the same under high inputs (98 bushels per acre) and recommended input (90 bushels per acre) vs. wide-row under recommended inputs (93 bushel per acre). Also, the three treatments yielded the same (119,110, and 115 bushels per acre, respectively) in the corn-following-soybean experiment. Weed densities, which did not differ among the three treatments, were exceedingly high in both experiments, which may or may not have influenced the data of both experiments. At the time of this writing, grain N concentrations and residual soil nitrate concentrations had not been analyzed, so it is premature to draw any firm conclusions from the first year of this three-year experiment.

Specific Project Results

Silage. When averaged across experiments, narrow-row corn silage with high inputs had final plant populations of 40,860 plants per acre, compared with 34,804 plants per acre for wide-row, and 35,789 plants per acre for narrow row under recommended inputs. When averaged across the three experiments and within each experiment, all three treatments had the same PSNT values. The average values, which ranged from 34 to 38 ppm, indicated very high soil nitrate concentrations in mid-June for all three treatments. Whole plant N concentrations, which were taken at the same time as the PSNT test, did not differ among the treatments within each experiment or when averaged across experiments.

The critical whole-plant N concentration for corn at the sixth-leaf stage of development (V6) is 3%. All three treatments had average whole-plant N concentrations greater than 4.3%, which suggests very high plant N status at this time. Ear-leaf N concentrations, however, which did not differ among the treatments within individual experiments or when averaged across experiments, averaged only 2.68 to 2.74%. Critical ear-leaf N concentrations ranged from 2.5 to 2.75% so the ear-leaf N concentrations do not indicate exceedingly high N status in the plant at silking. The corn plants, however, had attained a height of 11 feet at silking, so the very robust growth of corn at this site may have resulted in a "dilution effect" of ear-leaf N concentrations.

Although soil and plant N concentrations did not differ among the three treatments, narrow-row corn with high inputs yielded greater than the other two treatments when averaged across experiments. Narrow-row corn with high inputs had its greatest yield advantage in first- and second-year corn, but yielded the same as the other two treatments in continuous corn. It is not clear why narrow-row corn with high inputs yielded more in two of the three experiments because the nitrogen dynamics did not differ among the three treatments. It is doubtful that the 5,000 to 6,000 plants per acre population advantage for narrow-row corn with high inputs provided a 0.9 ton per acre yield advantage, because previous small-plot research did not show any silage yield differences between populations of 36,000 and 42,000 plants per acre. Likewise, the 7.25% yield advantage for narrow row corn with high inputs vs. wide rows with recommended inputs is somewhat greater than the 5% yield advantage in previous small-plot research.

Unfortunately, the dairy farmer at this site hires a custom applicator to apply herbicides to the 600 acres of corn silage that he produces. The custom applicator refused to apply a reduced herbicide rate to the narrow-row corn with recommended inputs because in New York less than the labeled rate is considered illegal. Consequently, we could not evaluate the weed control in narrow-row corn with reduced herbicide rate. We did evaluate weed control at the time of PSNT sampling, and found that all three treatments had excellent weed control. We did apply soil insecticide at planting in the continuous corn experiment at half the rate in narrow row corn with recommended inputs and at full rate in narrow

row corn with full inputs. Root ratings and visual observations indicated that corn rootworm pressure was very low in continuous corn at this site.

Grain. We did not attain our targeted population (27,000 plants per acre) in narrow-row with recommended inputs (22,974 plants per acre) or wide-row with recommended inputs (25,119 plants per acre) in the continuous corn experiments. In the corn-following-soybean experiment, we were closer to targeted population with narrow-row corn at high input at 33,476 plants per acre compared with 26,825 in narrow-row with recommended inputs and 24,588 in wide-row. The low populations in the continuous corn experiment are probably related to the zone tillage system that the farmer used and the very high corn residue levels at planting. Because of the low populations in the continuous corn experiment, we did not average the results of this study across experiments.

The participating farmer also applies all his N at planting, so we did not run the PSNT test at this site. Nevertheless, whole-plant N concentrations at PSNT time (V6 stage of corn) indicated high whole-plant N concentrations in both experiments (3.64 % and 3.99%) with no differences among the three treatments in either experiment. Likewise, ear-leaf N concentrations did not differ among the three treatments at silking in either experiment, despite the narrow-row corn treatment with high inputs receiving 30 lbs more N per acre at planting. Ear-leaf N concentrations ranged from 2.4% to 2.67%, which indicates close to adequate N status for all three treatments in both experiments.

Grain yields also did not differ among the three treatments in either experiment. Grain yields were quite low in the continuous corn experiment, probably because of the low corn densities and high weed densities in this experiment. Grain yields were somewhat better in the experiment where corn followed soybean, but nevertheless were probably reduced because of high weed densities at this site. Next year we will ask the farmer to do some tillage at this site to minimize the potential for low corn densities and high weed densities.

As at our silage site, the participating farmer hires a custom applicator to apply herbicides to his cornfields. Again, the custom applicator at this site refused to apply less than labeled herbicide rates because of the liability in New York. We did take weed density counts in late June (V6 stage of devel-

opment) and found weed densities of 5 to 10 weeds per m² in both experiments with no differences among treatments. Consequently, narrow-row corn did not result in more corn competition to the weeds at a site with very high weed pressure. Corn rootworm pressure was also very low in the continuous corn (actually, second-year corn) experiment and there were no differences in root ratings among treatments.

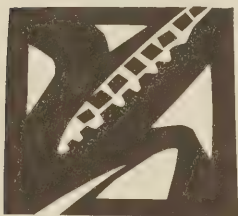
Site Information

Silage. Three field experiments of ten acres each, were established on the Table Rock Farm, which has 1,000 cows in Castile, New York. Willard DeGoyler is the participating farmer at this site. The three experiments were first-year corn (following alfalfa), second-year corn (two years removed from alfalfa), and continuous corn. The participating farmer performed all field operations (except herbicide application) including manure application, tillage operations, plowing, and harvesting. The soil at this site is a Tioga gravelly silt loam soil with a pH of about 6.5 in all fields. A complete soil test analysis was done before planting and will be performed after the experiment is completed.

Table Rock Farm is considered a progressive farm in Wyoming County, the leading dairy county in New York. Willard adopted narrow-row technology four years ago, and probably influenced the other ten or so dairy farmers who also adopted narrow-row technology. Table Rock Farm abuts Southview Farm, which lost the non-point source pollution lawsuit a few years ago. Table Rock Farm is in the center of a very intense dairy production region, so our experiments will receive high visibility.

Grain. The grain site is located near Cato, New York in Cayuga County, the leading corn-producing county in New York. Two experiments of seven acres each were established at this site. The two experiments were first-year corn (following soybean), and second-year corn (two years from soybean). The participating farmer at this site performed all field operations (except herbicide application) including fertilizing, planting, and harvesting. The soil at this site is a Honeoye silt loam with pH of about 7.0. A complete soil test was performed in both experiments before planting and will be repeated again after the experiment is completed. Ed Primrose is the participating farmer at this site and he is also a seed dealer for Golden Harvest.

Reported December 1998



Enhancement of Sustainable Pest Management Techniques through the Use of Banker Plants & Colored Mulch

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Pennsylvania State University
Twin Springs Fruit Farm
Wilson College Center for Sustainable
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SARE Grant

\$144,774

Match

\$25,038

Duration

1996 to 1999

Project Number

LNE96-70

Summary

During year two of this project, colored plastic mulches (blue, red, silver, and yellow) trials were conducted in a commercial greenhouse tomato operation to examine their effect on insect development and crop yield over a five-month crop cycle. Black polyethylene plastic was used as a standard. The total marketable yield for each color was determined. Yield increases ranging from 5 to 10% can be expected from plants grown on the colored mulch compared to plants grown on the standard black mulch. This second year study again indicates that insect populations can be manipulated with mulch color.

The "banker plants" that serve as a host for the establishment of insect pests and the appropriate biocontrol is under development. A colony of *Encarsia formosa*, the Hymenopteran parasitoid used to control greenhouse white fly, was successfully established. A colony of the parasitoid *Aphidius colemani* was established to control green peach aphid and potato aphid. The banker plants will be used in the future as a distribution method for natural enemies in commercial operations. Better understanding of these two concepts and their integration will augment the effectiveness of other Integrated Pest Management (IPM) strategies, and may serve as a catalyst for increased adoption of IPM in greenhouse operations throughout the nation.

Objectives

- ◆ Evaluate the effect of polyethylene mulch color in a greenhouse environment on crop and pest response.
- ◆ Develop a strategy to utilize banker plants as a distribution method for natural enemies in commercial greenhouse production.

Key Results

Colored polyethylene mulch used on the ground beds in the greenhouse of this experiment included red, yellow, blue, and silver, with black as the control. All polyethylene mulches were non-degradable and one millimeter thick. The highest fruit yield was harvested from plants growing on blue mulch (10.7% yield increase compared to the control) and the lowest yield was from plants growing on the control black mulch. Silver and yellow produced similar yields (10.7% yield increase compared to the control) and red only produced a 3.5% increase in fruit yield from plants grown on this color compared to the control. There was no significant increase in soil temperature from the different mulch colors, and there was no consistent trend in soil temperatures by color over the growing season. Recent field research has demonstrated that a more reflective red mulch has produced higher fruit yields of tomato from plants grown on reflective red compared to either the dull red or standard black mulch.

Insect development on tomato plants varied with mulch color. Results in 1998 were consistent with 1997 findings. The three target pests for this tomato crop included western flower thrips, potato aphid, and greenhouse white fly. Immature stages of western flower thrips were observed first on plants grown with the blue mulch. For ten of the twelve weeks in which the crop was monitored,



thrips development was highest on the blue mulch for both adult and larval stages. Results indicate that greenhouse white fly and potato aphid (adults and immature stages) developed first on plants grown with the yellow mulch. Yellow mulch was also an attractant for thrips; however, population development was not as great as it was on the blue mulch. Red, silver and black revealed low levels of all pests. This data indicates that blue and yellow serve as pest reservoirs and can be used to manipulate pest development. When identified, these areas can be used as to make target applications of beneficial insects. Strategic placement of biocontrols near the pest population increases the efficacy of the treatment.

Using colored mulch in commercial tomato production has resulted in elimination of synthetic insecticides; control was obtained using biological controls with the colored plastic mulch.

The development of the banker plant system was moved from a laboratory situation to a commercial tomato operation. Six-foot-high cages were erected, since it was determined in 1997 that rearing cages needed to be larger. In one cage, greenhouse white fly adults were introduced and allowed to oviposit on tomato plants. Adults were removed from cage and immatures allowed to develop to suitable stages (third instar) for parasitism. The parasitoid *Encarsia formosa* was then introduced into the cage. Leaves containing parasitized pupae were then distributed in the production houses. These production houses were augmented with *Encarsia* purchased through a supplier since there were not adequate amounts to control white fly populations.

The same efforts were made to rear the parasitoid, *Aphidius colemani* to control green peach aphid and potato aphid. Additional introductions of *A. colemani* were purchased to augment those reared in the cages.

Future efforts will be made to increase the number of parasitoids. Other efforts will be directed at improving air circulation in rearing cages. Slow air movement has increased the incidence of foliar diseases developing, such as powdery mildew and leaf mold. Further development of the banker plant system will offer growers the option of having a sustainable, on site supply of biological controls when an insect pest problem develops during crop production.

Farmer Adoption

All growers involved in the project reduced their dependency on synthetic pesticides. Grower one experienced a 95% reduction and grower two a 75% reduction.

One of the growers has allowed the project to expand to two production houses. The grower talks of using effective colors separately in houses, especially for control of western flower thrips. The grower involved with banker plant study has expressed interest in using the colored mulches so that the biocontrols work more effectively.

One grower reports, "The use of colored plastic mulch in our operation definitely will work. The plastic mulch can be applied easily to the top of the troughs. Anything that will make the biocontrols more effective we are all for. Since we are so limited with registered pesticides, we must be constantly looking for other methods to keep production going. My employees are happy since their exposure to pesticides is greatly reduced." Another says, "We like the idea of rearing beneficial insects on our operation. The use of the banker plant system will provide us with a steady supply of biocontrols. Since we market our tomatoes as an IPM grown commodity, our participation in these types of projects is crucial to keep the greenhouse vegetable industry strong."

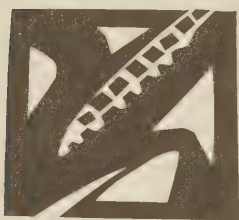
Dissemination of Findings

The project has been presented and discussed at eight plasticulture and vegetable production workshops and meetings across Pennsylvania during 1998, and the project has been published in a professional journal (Orzolek, M. D., W. J. Lamont and L. Otjen. 1998. Day-neutral strawberry production on colored mulch. *Proc. Nat. Ag. Plastics Cong.* 27:199-202.). Further dissemination is pending.

Reported December 1998

Project Number

LNE96-70



Northeast Kingdom Nutrient Management Project

Coordinator

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Collaborators

Area farmers
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Conservation District
University of Vermont Extension
Service
USDA Natural Resources Conservation
Service

SARE Grant

\$18,920

Match

\$24,470

Duration

1997 to 1999

Project Number

LNE96-75

Summary

This project is looking for ways to improve whole-farm nutrient management. The focus has been on reminding farmers about the value of soil and manure testing, the necessity of keeping good records, and the benefits of good nutrient management.

Objectives

- ◆ The project will demonstrate that more intensive management of nutrients across the whole farm can result in improved economics, healthy soil and crops, and a lower danger of excess nutrients going into groundwater or streams.
- ◆ The project will involve a local conservation commission, local schools, community lay monitors and a lake association in order to involve the communities in the shared goal of sustainability. This will serve as a demonstration of how community involvement in sustainable agriculture can return farming to its central role.
- ◆ The project will address nutrient imbalances within a small watershed by involving most of the farms in that watershed, including both dairy and diversified farms.

Results to Date

The farmers involved in this project are showing greater interest in managing the nutrient requirements of their fields, and four of the six are now taking samples on fields that are not included in the project. The information from the lab reports is being used in planning for manure and fertilizer management. The results of a demonstration plot where corn was grown with and without starter were not definitive; the excessive rains this summer may have affected that outcome. We hope to continue the demonstration over a period of years. This particular farm uses a fairly high level of inputs, and the farmer is interested in seeing if a reduced level will hurt his yield over the long run. Record keeping is a continuing challenge.

An effort was made to educate landowners in one community about the requirements for making and keeping land productive. Most of the farmers in the county lease land, and there is a tendency not to invest as much in the lease land because there is no guarantee of a return. Handouts were prepared showing the average costs for maintaining productive land with average returns by the acre. Letters were sent to all landowners in the community, and one of the farmers personally contacted several landowners and the conservation commission was invited. Although turnout was not good for this initial meeting, we would like to try it in other communities, as this is an important issue for area farmers.

A second meeting was held for all farmers in Caledonia County with UNH Extension agronomist Tom Buob. Tom proposed an integrated pest management project to the seven farmers in attendance. A number of farms became involved this summer and we hope to extend the project through the coming summer.

Another community effort involved a water-quality issue in one of the small watersheds where two of the farms are located. All the landowners in the watershed were invited to attend a meeting to discuss their pond. A representative from another pond association and an aquatic biologist from the Vermont Department of Environmental Conservation attended. This first meeting brought out a large group concerned about water quality. Many of them were camp owners; most did not know each

other. The group decided to start a pond association and a lay monitoring program. As a result of the meeting, another farm in the watershed plans to fence their heifers out of the pond and install a pasture watering system. One of the farmers enrolled in our project has already fenced off the main stream that feeds into the pond. The interested landowners realize this will be a long-term project and that all sources of nutrient discharge into the pond must be investigated, including possible failed septic systems at the camps. There is an attitude of cooperation with a healthy focus on returning the pond to a better nutrient balance.

Specific Project Results

The whole-farm nutrient management and water quality portion of this project has presented several issues. One issue for the farmers, and for many others in the project, is maintaining an adequate land base. Much of the land our farmers use is leased; consequently, the farmers are concerned about investing in someone else's land without knowing how long they will be able to use it. This means that, when planning the distribution of their manure supply, they tend to be lighter on lease land, as well as any far fields, because of added time and costs of transporting manure greater distances. We have not found that individual farms have too much manure for the available land base if it is well distributed. However, in two cases there are excess chemical fertilizers being used in addition to the manure.

We have found an increased interest in soil testing. We have been sampling six fields on each farm; four farms are now sampling additional fields. As mentioned, the economics of managing lease land and far fields has been identified as an issue for the distribution of manure and maintenance of productivity, as has crop rotation for erosion control and weed management on a limited land base. There is a need to pay attention to pH and potassium as well as nitrogen and phosphorous.

Pre-sidedress soil nitrate testing identified a major nitrogen deficiency due to the rains. We found a need to build a local body of knowledge in integrated crop management as a resource to farmers and others. Improved record keeping is a must.

Community involvement in the project seems to have a direct relationship to how relevant a topic is to community member interests. A workshop for

landowners who lease land to farmers had only five community members attend. Another meeting of landowners that focused on water quality had excellent participation, and produced a commitment to form a pond association and a lay monitoring program. A farm not involved in our project is actively working to keep nutrients from one of their pastures out of the pond.

In the two watersheds where there are water-quality concerns, the majority of the farmers are involved with the project. Still, one or two farms we would like to get involved have declined. All the participating farms are dairy and have a keen interest in protecting water quality as well as improving their fertility programs.

Potential Impacts

Several issues have surfaced in this project. One is the lease land problem, which encourages farmers to concentrate their more intensive crop production on smaller acreage and not rotate out of corn as often as they should. The soil testing has helped farmers to realize the benefits of knowing more precisely what their soils need. In some cases, excess liming had been a problem; in others, liming had been postponed because it did not seem as critical a need. Potash has also been found to be deficient in some fields, especially where manure management has not been good. A potential outcome of this project is better targeting of nutrients by increased soil sampling and the potential reduced use of chemical fertilizers. We also need to work out a method of communicating to leaseholders the farmers' costs to maintain the leased land against the value of the yield, and the need for long-term contracts that protect the farmers' interests as well as their own.

Reported December 1998

Project Number

LNE96-75



Sustainable Phosphorus Fertilizer Recommendations for Corn Production in the Northeast

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Potash & Phosphate Institute of Canada
Rutgers Cooperative Extension
Universities of Connecticut, Delaware,
New Hampshire, Maine,
Maryland, Massachusetts, Vermont,
and West Virginia
University of Maine Cooperative
Extension

SARE Grant

\$92,780

Match

\$102,766

Duration

1998 to 1999

Project number

LNE97-93

Summary

There is consensus among soil fertility scientists in the Northeast that soil test recommendations must be reevaluated to ensure that fertilizer recommendations are valid for modern crop and soil conditions. This need has become increasingly urgent because of environmental concerns about the rising phosphorous (P) levels indicated by soil tests.

This grant is supporting twelve northeastern states currently involved in a major soil fertility research project. Their collaborative efforts will result in Cooperative Extension materials and programs that will help corn producers improve phosphorus fertilizer recommendations.

Objectives

- ◆ To reevaluate corn responses to phosphorus fertilizer in the Northeast using current crop production technology and soil test methods.
- ◆ To determine the soil test phosphorus level that divides responsive soils from nonresponsive soils with respect to use of starter phosphorus fertilizer and broadcast phosphorus fertilizer.
- ◆ To update phosphorus fertilizer recommendations for corn production in the Northeast.
- ◆ To educate corn producers about sustainable soil phosphorus fertility management practices.

Results to Date

Experiments were conducted at 32 field locations in 1998 that represented a wide range of soil test levels for available P. Samples are being analyzed using a variety of soil test extractants.

Methods

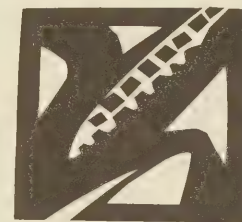
Soil fertility scientists within the Northeast Coordinating Committee on Soil Testing agree that there is a lack of current field calibration data to provide agronomically sound phosphorus recommendations for modern crop and soil conditions. A need for soil test phosphorus calibration data has become increasingly urgent due to changes in soil test methodology, increases in on-farm soil fertility levels, higher crop yield goals, concern over water pollution from excessive soil phosphorus loading, and the need to improve the economic viability and sustainability of agriculture.

To build a new soil test data base, field experiments are being conducted in twelve northeastern states (Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, and West Virginia) to evaluate corn response to starter and broadcast phosphorus fertilizer at 64 field sites. Soil samples from each of the experimental sites were collected and are being analyzed using each one of the soil test extractants (Morgan, Modified Morgan, Mehlich 1, Mehlich 3, and Bray) that are in use in the Northeast. Plant tissue samples were collected to evaluate plant P nutritional status. Cate-Nelson analysis is being performed in order to examine the relationship between soil test P level and corn yield response to P fertilizer. The soil test P critical level will be determined for each soil test extractant. All crop response and soil test data is being shared among participating states.

all states

Reported December 1998

Soil Amendment & Crop Rotation Effects on Productivity & Soil Properties within Potato Production Systems



Summary

Participants will study the residual effects of soil amendment programs and crop rotation in potato production systems. The project includes experiments on crop rotations and soil amendments and examinations of soil changes, crop productivity, and nutrient uptake several years after amendment applications have ceased. The project seeks to study the long-term effects of these production strategies. It builds on previous work that demonstrated short-term production benefits from rotations and amendments.

Objectives

- ◆ Research will be conducted on the effects of crop rotation and soil amendments (compost, manure, and paper mill sludge). For soil amendments, special emphasis will be on effects occurring several years after applications have ceased, because these effects will be critical to the economic viability of soil amendment use on commercial farms. An economic analysis of the research data will be completed and results of the entire project will be disseminated to the Maine potato industry.
- ◆ Water infiltration rates, runoff, and sediment removal will be compared for several crop rotation schemes and for amended versus nonamended soils under potato production.

Abstract

Due to intensive cultivation and short cropping cycles, potato production in the Northeast can lead to excessive soil erosion, loss of organic matter, and poor aggregation. This can limit productivity and result in negative effects on ground and surface water. Research conducted at the University of Maine and on growers' farms since 1991 has provided ample evidence that soil fertility and physical properties can be improved when soil management includes compost and manure application. Yields in these amended systems are almost always higher than conventionally managed systems; however, short-term economic analyses typically show lower profits due to the relatively high costs of amendments. The economic situation would be favorable, however, if long-term or residual benefits due to amendments were included in the analysis, specifically benefits to soil fertility, soil physical properties, and crop yields that persist for several cropping cycles. Beneficial crop rotations would be expected to have similar effects, though they would likely occur only after much longer periods.

We will study the residual effects of soil amendment programs and crop rotations within potato production systems. Compost, manure, and paper mill sludge are locally important and representative of three broad types of soil amendments available throughout the Northeast. Emphasis for the amendment treatments will be on soil changes, crop productivity, and nutrient uptake occurring several years after amendment applications have ceased.

Farmers will identify critical questions concerning soil management and will help design and conduct trials on commercial farms.

Approved for funding March 1998

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Collaborators

Maine Cooperative Extension
System
University of Maine

SARE Grant

\$100,126

Match

\$48,942

Duration

1999 to 2001

Project number

LNE98-103

ME



Development of a Knowledge Base for the Site-Specific Application of Crop Nutrients

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Collaborators

Cornell University
Culver Agricultural Enterprises
New York farmers

SARE Grant

\$109,968

Match

\$187,964

Duration

1998 to 2001

Project number

LNE98-110

Summary

This combined research and demonstration project will compare the economics of site-specific or precision agriculture and the uniform application of nutrients. It will look at soil variability and crop response to variable nitrogen (N), phosphorous (P), potassium (K), and lime inputs on two crop farms in central New York.

Objectives

- ◆ To evaluate spatial and temporal variability of soil properties, soil-related yield limiting factors, and crop yields within fields in the major grain production area of New York.
- ◆ To evaluate the benefits of variable-rate technology in New York and make recommendations on its implementation.

Abstract

Precision agriculture is based on the supposition that efficiency is gained from variable application rates of agricultural chemicals within fields as opposed to conventional, uniform applications. It also assumes that these targeted applications will reduce the environmental impact of fertilizer and pesticides.

The economic value of precision agriculture depends on the degree of soil variability, the cost of the chemical input, and the yield response. The environmental value of precision agriculture is the precise application of the input to a specific site, thereby reducing the potential for off-site losses to surface water and groundwater. The greatest economic and environmental benefits of precision agriculture are variable application rates of N, P, K, and lime. The proposed research will focus on the effects of soil variability on crop response to variable N, P, and K, and lime inputs.

We will conduct research and demonstrations of precision agriculture on drained and undrained fields on two crop farms in central New York. In the first year, we will collect and process soil and crop-related information for the development of maps for site-specific applications of N, P, K, and lime. In years two and three, each field will be managed in alternating strips using uniform and site-specific methods. An economic analysis of the two management systems will be performed at the conclusion of year three. Field Days will be conducted in years two and three. Results of the research will be disseminated via winter workshops, written educational materials, and a symposium. Surveys at the onset and termination of the project will evaluate its impact.

Approved for funding March 1998



Alternate Grain & Bean Rotations for Optimized Economic Yield in Northeast Organic Farming



Summary

This project will take a whole-system approach to evaluating the use of intercropping and mixed cropping with small grains, field peas and faba beans to produce organic animal feed grains and millable grains for human consumption. This collaborative effort of nonprofits, educational institutions, producers, and processors will examine production and marketing factors. It is designed to respond to increased demand for organic grains.

Objectives

- ◆ To address a rapidly expanding organic milk market in the Northeast that is not being met with commensurate production of local organic feed grains.
- ◆ To enhance the sustainability of farming systems by intrinsic production of small grains and bean-legumes.
- ◆ To explore the viability of field beans and field peas in a mixed growing system with soy beans in the Northeast.
- ◆ To include small grains, especially wheat, in grain-legume rotations, enhancing the economic choices and therefore the viability of local northeast farmers.

Abstract

The emergence of new markets for organic small grains and beans in the Northeast is a significant reason for farmers to conform management structure to include these crops. Driving factors are concerns for sustainability and the dramatic increase in organic milk production in Vermont and Maine and, overall, a significant increase in demand for organic milled grains for human consumption. The importation of feed and food grains from other regions is cost prohibitive for local organic production, even with increased premiums for certified organic products. Economically optimized production and marketing strategies are needed to sustain the growth.

The proposed project is a whole-system approach to evaluating the use of intercropping and mixed cropping with small grains, field peas, and faba beans to produce animal feed grains with appropriate protein composition and millable grains for human consumption in organic markets. The proposal will carefully evaluate the agronomy through plot and on-farm trials, and also will analyze the economic optimization factors in view of existing and emerging diverse markets.

Approved for finding March 1998

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Collaborators

Borealis Breads
Maine Organic Farmers and
Gardeners Association
Morgan Mills
Thomas College
University of Maine Extension
System
Woods End Agricultural Institute

SARE Grant

\$68,604

Match

\$34,965

Duration

1998 to 2000

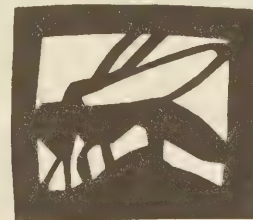
Project number

LNE98-113

ME



bees



Impact of Herbicides on Beneficial Insects of Blueberry & Cranberry

Summary

This project is investigating the effects of herbicides on the diversity and abundance of forage plants and beneficial Hymenoptera (bees and wasps) in blueberry fields in Maine and cranberry bogs in Massachusetts.

Objectives

- ◆ Determine the effects of herbicide use on flowering weeds (diversity and abundance) and Hymenoptera (diversity and abundance).
- ◆ Determine the extent that field border characteristics reduce the effects of herbicides on the diversity and abundance of Hymenoptera.
- ◆ Determine how the abundance and diversity of beneficial Hymenoptera influences crop productivity (fruit set, berry weight, and seeds per berry).

Abstract

The goal of this research is ultimately more sustainable production of lowbush blueberry and cranberry through more reliance on beneficial insects and less reliance on pesticides in these important and extensive agroecosystems in the Northeast. This in turn will contribute substantially to a cleaner environment and safer, healthier food. Broadleaf herbicides kill plants that bees and wasps use for forage. Other herbicides control grasses, rushes, and sedges, which while not forage plants, may provide important microhabitats for some beneficial bees and wasps. Sixteen lowbush blueberry fields and ten cranberry bogs were sampled in 1998 for diversity and abundance of noncrop plants and Hymenoptera. For lowbush blueberry, 42 weed species were found; the number of flowering plant species present ranged from three to thirteen species per study site, including species present in the adjacent forest. The most prevalent species were bunchberry, sheep laurel, raspberry, and bush honeysuckle. For cranberry, the species present ranged from 11 to 46 per site. The most prevalent weed species for cranberry were dodder, yellow loosestrife, dewberry, and cat's ear. Over 2,400 samples have been sorted into major categories of beneficial Hymenoptera, a subset of which have been sent out for identification so that the presence and abundance of individual species can be correlated with weed cover and yield findings.

A preliminary analysis investigating beneficial Hymenoptera abundance in blueberry for 1997 indicates that field size and percentage weed cover were related to the number of parasitoids that were recovered. In general, large fields had 41% more wasps than small fields, and the weedier fields had 27% more wasps. An important new finding in 1998 is the presence of an excellent pollinator of cranberry, previously only known in New Jersey bogs. We have found the leaf-cutting bee *Megachile addenda* in Massachusetts cranberry bogs; in fact it was the most abundant bee captured and was present in all bogs sampled in 1998, which suggests it has good potential as a supplemental pollinator in Massachusetts cranberry bogs.

Project Results

Transect sampling sites and floating-line transects indicate that, for lowbush blueberry, the number of flowering plant species present ranged from three to thirteen per study site—this

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Collaborator

University of Maine

SARE Grant

\$150,000

Match

\$148,627

Duration

1996 to 1998

Project Number

1NE96-64

ME

includes species present within the adjacent forest. The most prevalent species were bunchberry, sheep laurel, raspberry, and bush honeysuckle. For cranberry, the number of flowering plant species present ranged from 11 to 46 per study site. The most prevalent weed species for cranberry were dodder, yellow loosestrife, dewberry, and cat's ear. Hymenopteran abundance and diversity was again estimated using baited plexiglas traps, plexiglas flight interception traps, and malaise traps. In addition, nine 30' to 45' towers of 2" rigid conduit were erected at six sites; at each tower an intercept trap was suspended at three different levels. Also, sweep-net samples were taken in seven fields as well as one-minute visual counts of bees in each of 15 1m² vegetation plots during bloom. Two hundred wooden nesting blocks for leaf-cutting and mason bees (Megachilidae) were set up in cranberry bogs (20 per field); the bees will be reared out this February. In 1998 for cranberry, 11 nonparasitic bee genera were collected: *Agopostemon*, *Andrena*, *Augochorella*, *Bombus*, *Ceratina*, *Colletes*, *Dialictus*, *Evylaeus*, *Lasioglossum*, *Megachile*, and *Osmia*.

Cluster analysis was used to group cranberry bogs sampled in 1998 by floral and plant density per taxa. There were no groupings of floral or plant density that closely matched the cluster tree produced from an analysis of the number of bees by genus. At this time it does not appear that the differences in bee communities and floral and plant density between bogs are directly related. However, it should be noted that many of the bogs adjoined residential areas with ample floral resources. The analysis also revealed clear regional differences existed between bee communities.

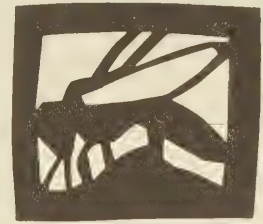
Dr. J. Cane has confirmed our identification of the leaf-cutting bee *Megachile addenda*, which is an important new record for Massachusetts cranberry bogs because Cane found it to be an effective pollinator of cranberry in New Jersey. In 1998, this species was the most frequently captured bee and was present in all bogs sampled, which suggests it has good potential as a supplemental pollinator in Massachusetts cranberry bogs.

The density of bees and wasps in and across blueberry fields in 1997 was dependent on trap placement. Estimates ranged from 1.8 to 3.6 times as many wasps recovered in the forest than in the blueberry fields, depending on the trap type. By contrast, the number of bees was higher in the blueberry field than in adjacent forests for the intercept and sticky traps but somewhat lower in the malaise traps.

There was no apparent relationship between the number of bees recovered in 1997 from blueberry fields and the variables of field size or weediness. By contrast, both field size and percentage weed cover were related to the number of parasitoids that were recovered. In general, large fields had 41% more wasps than small fields, and the weedier fields had 27% more wasps than the less weedy fields.

A measure of herbicide-intensity for 1998 is being derived from our periodic visits to the study sites, grower spray records, and interviews with growers. It would be premature to draw major conclusions until the data are analyzed for the 1998 samplings. As for our inquiry into the extent that field border characteristics reduce the effect of herbicides in Hymenoptera, we are still sorting samples and herbicide data. We are also collecting productivity records for blueberry; the cranberry productivity records are complete.

Reported December 1998



Evaluating a Heat-Therapeutic Control of the Honeybee Mite *Varroa jacobsoni*

Summary

Varroa mites first appeared on agricultural honeybees in North America in 1987. Today, virtually all commercially productive honeybee colonies in the US must be treated to control Varroa mite infestations or the hives die within three years. Currently, US beekeepers are relying on fluvalinate (commercial name Apistan), the only approved pesticide available to them. This project evaluated and developed a method of managing varroa mite infestations with heat alone. A simple cabinet-type heating apparatus, similar to that used by beekeepers in Uzbekistan, was constructed, tested and improved.

Objectives

- ◆ Use efficiency studies to determine the percentage of mites removed using bee-safe temperatures and treatment times for sizes ranging up to the entire adult bee population of an established colony.
- ◆ Identify and attempt improvements to the heat-therapy apparatus and procedure related to the effectiveness and ease of handling bees during treatment.
- ◆ Assess the winter survival of varroa-infested nucleus colonies that were heat-treated during the preceding fall.
- ◆ Assess the influence of spring and fall-and-spring heat treatments on the health and honey production of varroa-infested nucleus colonies during the following summer.
- ◆ Measure the influence of heat therapy on the population levels of the endoparasite *Acarapis woodi*.

Key Results

Heat treatments removed between 82% and 98% of the varroa mites from treated colonies. This rivals the efficiency of experimental organic acid treatments and miticides such as fluvalinate.

Treated colonies showed markedly lower varroa populations through the entire summer and fall following treatment.

Beekeepers who think they have enough labor to treat with heat should begin using this method as part of an integrated pest management approach to honeybee mite control. Heat therapy would likely prove compatible with bee breeding for mite tolerance, the sale of nucleus colonies and package bees, and the production of organic honey and wax.

Effectiveness of most methods of controlling varroa can be improved by treating during broodless periods.

Varroa control requires avoiding post treatment reinfestation from other apiaries. It is important for beekeepers to treat at the same time or to establish sufficient buffer distances between apiaries.

Method and Findings

Varroosis affects larval, pupal and adult stages of honeybees with a wide range of symptoms, some of which are associated with known honeybee viruses (parasitic mite syndrome or

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Collaborators

Area farmers
Pennsylvania State University
Marlboro College

SARE Grant

\$20,000

Match

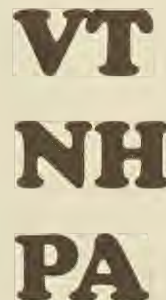
\$8,885

Duration

1996 to 1997

Project number

LNE96-66



PMS). Currently only one approved miticide, fluvalinate (trade name Apistan), is available to an estimated 140,000 to 211,600 US beekeepers for controlling varroa. It is generally agreed that the effectiveness of this miticide is unsustainable, and some populations of Varroa already exhibit resistance to fluvalinate.

Although Apistan is a class III pesticide, there exists concern about residues persisting in beeswax comb. Thermotherapy is one of the few effective alternatives available, and as such offers an important tool to beekeepers concerned about chemical residues in their hives. Thermotherapy can replace the use of fluvalinate.

The apparatus used in this project followed the design of a homemade device in use in Uzbekistan, where varroa mites have been an apicultural pest for decades. It consists of a portable wooden cabinet (11 inches by 16 inches) which accommodates a standard 1500 watt milk-house-type heater that stands on the floor of the cabinet and a wire mesh cylinder for suspending the bees in the upper portion of the cabinet. Plexiglass windows are fitted into the top and sides of the cabinet for ventilation and observation. Bees are shaken, brushed or blown from the hive's frames into the heat-treatment cage through a large funnel. The actual heating can take less than 15 minutes per hive, while the handling of the bees can take twice as long.

The heat-treatment involves temporarily removing the bees from a hive and exposing them to 46° to 48° C (114.8° to 118.4° F) for several minutes until most of the mites have been detached, but before the bees can be injured by the heat. This project deals exclusively with *extrohive* thermotherapy of honeybees and should not be confused with a patented device costing several hundred dollars that heats bees and the entire contents of the hive.

Preliminary heat-treatments enabled the project participants to develop bee-safe handling and heating procedures while determining the factors that limit the number of bees per treatment. An efficiency study showed that heat-treatments removed between 82% and 98% of the varroa mites from treated colonies. This rivals the efficiency of experimental organic acid treatments and miticides such as fluvalinate.

The extrohive thermotherapy was shown to be

inexpensive, as expected, but heat-treating is labor-intensive; interested beekeepers will need to learn the techniques involved. These techniques are not difficult, but operator inexperience or inattention can result in unnecessary loss of livestock. Findings include labor-conserving techniques such as preparing colonies for treatments and efficiency-improving techniques such as performing treatments nocturnally.

During the entire project an experienced apiculturist regularly inspected all colonies and recorded symptoms of disease, brood levels, varroa-mite counts, and honey production.

The study closely monitored 32 colonies over the course of a year to observe the health and productivity of heat-treated colonies relative to a control group. The project was conducted in areas of mixed woodland and small-scale agriculture in hilly areas of southeastern Vermont and southwestern New Hampshire on sites where varroa infestation pressure from other honeybee colonies was reduced by a two-mile or wider buffer radius.

Participants seeded 32 nucleus colonies of hybrid "Hardy Northern Stock" with varroa mites from donor colonies that had been infested for two years and exhibited symptoms of PMS. In October of 1996 the 32 colonies were randomly assigned to eight sites paired according to expected more or less favorable environmental factors so as to mitigate the effects of site on project outcomes. After normal wintering, 16 colonies at four sites were heat treated during a naturally broodless period in March and April of 1997; the 16 colonies at the other four sites were maintained as a control group. For the purposes of this efficiency study four colonies ranging from 456 to 1133 grams (1 to 2.5 pounds) were heat treated and the bees returned to their hives over a sticky board so that additional mite fall and bee mortality could be measured. The hives were brood-free and the comb reasonably clear of mites. Egress or ingress of bees was prevented by covering the hive entrances with wire mesh. Two plastic strips coated with 10% fluvalinate were inserted, and mite fall was counted over the next nine to fourteen days. This efficient treatment, administered to single-chamber brood-free hives, was expected to remove virtually all the remaining varroa mites. Efficiency of the heat treatments was calculated by dividing the number of mites detached during heat-treatment by total mites, and ranged

from 81.9% to 94.6%.

The efficiency of mite removal with two additional colonies was similarly measured except that, instead of a control treatment with Apistan, the bees were sacrificed and all remaining varroa mites counted. The efficiencies of these two treatments were 90.6% and 97.9% for colonies weighing 1420 and 1498 grams (3.13 and 3.30 lbs).

Contrary to expectations that treatment temperatures and durations would need to be minutely adjusted to maintain efficiency in treatment of different sample sizes, the 47° to 50° C range worked for all sample sizes below 1588 grams (3.5 pounds), as long as the cage was not overfilled and other operating procedures observed.

During heat-treatment trials, it became apparent that certain factors grossly affected the efficiency of treatments. For example, if the mixed adult bee population of a large varroa-infested colony was treated in successive batches, it became obvious that while a cage with ample space for air circulation produced an impressive mite fall, a cage overfilled with bees was slow to heat, detached very few mites, and was more likely to result in damage or death to bees. If the treatment cage was oversized for the cabinet, mite fall was also greatly reduced.

If overheating occurs, with the primary thermometer readings above 49° to 50° C, some bees began to regurgitate a clear liquid, became excessively lethargic, and were more likely to clump together in collective helplessness made worse by the cohesive effects of the regurgitated liquid. If the cage was overfilled, or the bees in the cage were in other ways allowed to clump together during heating, far fewer mites fell than with the treatment of loosely distributed bees from the same colony. So, whether clumping is allowed at the beginning of critical heating or results from overheating, bees are undesirably stressed and the efficiency noticeably reduced.

Improvements to the Heat-Treatment Apparatus and Procedure

Experience with heat treating bees enabled the participants to make improvements to the heat-treatment apparatus. It was discovered that bee handling and heat treating were greatly facilitated through preparatory manipulations, inspections, and choices of when to treat. Equipment factors included cage size, cage construction materials, and

the funnels used for transferring the bees from the hive to the treatment cage.

The same experience allowed the participants to improve the heat-treatment procedure by avoiding bee clumping and by consolidating bees onto selected frames in advance of treatment to minimize shaking and brushing and the risk of spilling honey or nectar. The timing of treatments, queen management, and treating during cold, broodless periods and after dark were also explored and refined. The need to keep apparatus clean to prevent disease transmission, improve thermotransparency, and remove accumulated alarm pheromones also became apparent.

Outcomes

The first outcome measure to distinguish treated from control colonies were sticky-board counts begun in July and August. The sticky boards consisted of oil-coated paper, separated from the bees by 1/8" mesh and placed on the floors of the colonies to show the number of varroa mites naturally falling in each colony. Analysis showed that the control group produced, as a mean, 7.2 times more mites per day than the treated group.

In second- or third-year infestations, untreated colonies of honeybees often crash dramatically and die after the annual varroa populations boom. This study was not funded for the two to three years necessary to compare control and heat-treated colonies over the full course of varroa disease.

Economic Analysis

When using chemotherapy, colonies are treated through the insertion of fluvalinate-coated plastic strips between the brood frames at \$3 to \$6 per year in materials, plus the labor to open and close each colony two or four times. The cost might be higher when we consider the likely appearance in the U.S. of mite resistance to fluvalinate, a problem already observed in Europe. Although perhaps labor saving, the actual cost of using fluvalinate can compare unfavorably with the more labor-intensive heat method over the course of several years. The coordinator calculates that in the Northeast it costs between \$433 and \$933 in materials and labor to treat 100 colonies with fluvalinate, not including transportation.

If a beekeeper acquired a heating cabinet, heat source, thermometers, and other needed equipment for a one-time cost of \$200, and if it took 45 min-

Project number

LNE96-66

utes (assuming labor cost of between \$7 and \$10 an hour) with each colony, it would cost the beekeeper between \$545 and \$770 each year with the initial equipment cost spread out over 10 years. An additional argument for using heat therapy arises if we take into account the likely increase in the cost of fluvalinate and the likely increased income from the sale of uncontaminated, premium-priced honey produced using heat therapy.

With organic honey standards in place in Vermont and other states, the number of specialty and certified organic producers is likely to increase dramatically in the next several years. Most standards do not allow use of fluvalinate in the production of honey labeled certified organic, and it is likely that all organic honey standards will similarly exclude or strongly limit the use of other pesticides.

When considering whether to attempt a program of varroa mite control using extrohive therapy, the beekeeper may consider several economic factors. Are the bee yards equipped with 120 volts AC electrical current? Can colonies be brought to a treatment site accessible to electrical current on an annual basis, or can bee yards be advantageously relocated with access to electrical current? Does the beekeeper intend to incorporate sustainable methods into all aspects of colony management

and processing, either with the intention of following a sustainable philosophy or achieving organic certification? If so, extrohive thermotherapy would be compatible with most any sustainable apiculture program.

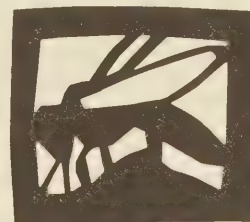
The additional labor required for extrohive thermotherapy can be weighed against the premium price customers are willing to pay for wax, honey and pollen from certified organic or colonies otherwise managed using sustainable methods.

Potential impacts of this project include providing a safe, sustainable alternative to decreasingly effective chemotherapies such as fluvalinate. Current apicultural practices that involve extensive handling of adult bees, such as the formation of nuclei and package bees, could be adapted with relative ease so as to incorporate heat treatments.

Prospects for the production of certified organic honey and other bee products will likely improve with the availability of non-chemotherapeutic varroa-control measures such as heat therapy. Organic honey production in the continental US is currently very low as a direct result of the lack of sustainable alternatives to chemotherapy for the control of varroa infestations.

Reported December 1997

Controlling Honeybee Mites with Essential Oils



Summary

This project will evaluate and improve the use of commercially available essential oils to control honeybee mites.

Objectives

- ◆ To control honeybee mites using essential oils in syrups fed to brood and in grease patties, slurries, and towels or pads.
- ◆ To identify the more effective essential oils and to develop and refine methods for the delivery of essential oils to honeybees in order to improve mite control and to reduce labor.
- ◆ To determine if samples of honey and beeswax from treated colonies contain residues of essential oils and other chemicals used to control mites.
- ◆ To disseminate information on controlling bee mites with essential oils to Cooperative Extension agents, beekeeping organizations, beekeepers and other interested individuals.

Abstract

The project will evaluate and improve the use of commercially available essential oils to control honeybee mites. Present methods will be refined to find better application methods, determine optimum time of delivery, and identify more effective essential oils. The project will compare the health and productivity of untreated colonies, colonies treated with Apistan alone, and colonies treated with essential oils. Samples of honey and beeswax from treated and control colonies will be sent to a laboratory for chemical analysis to determine the presence of residues of Apistan and essential oils in the honey and beeswax.

Results will be published in the *American Bee Journal* and will be disseminated via public meetings and in other printed matter to beekeeping clubs and societies, the state departments of agriculture, and county extension agents. Findings will also be listed on a web site on the Internet at <http://www.wvu.edu/~agexten/varroa/>. A West Virginia University Agriculture and Forestry Experimental Station pamphlet or circular will be prepared and made available to agencies and individuals interested in bees.

Approved for funding March 1998

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SARE Grant

\$80,000

Match

\$14,904

Duration

1998 to 2000

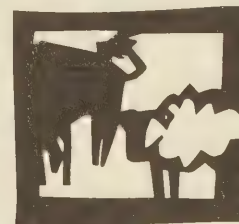
Project number

LNE98-105





dairy & livestock



Nutrient Management on Maine Dairy Farms

Summary

This project has focused on identifying farmer's questions on nutritional management and use, and to then develop on-farm projects that answer these questions. Producers play an important role in these activities, and the project has stimulated on-farm research. The project has also been featured in workshops, discussion groups, field days, farm visits, and other events that involve producers, state and federal agencies, and industry.

Objectives

- ◆ Farmers will identify emerging information and technology needs for nutrient management on dairy farms, and will develop site-specific criteria for making nutrient decisions.
- ◆ On-farm evaluation of available nutrient management technologies will be conducted on at least 20 sites in Maine for two years by a team of university researchers and cooperating farmers to create a local database on crop yield and quality response. An economic evaluation of alternative nutrient management strategies will be conducted for all sites based on this data set.
- ◆ Two alternative nutrient management strategies—manure application to seeding and established alfalfa, and grass response to different forms of manure—will be evaluated in applied research projects. Results will be disseminated to all Maine dairy farmers.
- ◆ A comprehensive management framework for record keeping and decision making will be developed to aid farmers in making decisions regarding nutrient use.

Results to Date

As this project enters its final stages (it will end in March, 1999), much time has been committed to providing education on nutrient management using information from on-farm trials and several experiment station research efforts. Sixty-five dairy farmers and advisors participated in the first of five sessions called "Managing Forages and Nutrients for More Profit." The focus of this initial session was on the tools used to make nutrient use decisions on dairy farms and on managing fertility sources on annual and perennial crops. Much of the information presented in this workshop was developed through on-farm trials over the past three years.

A post-workshop survey indicated that participants would likely make changes in many areas, including soil testing (23%), manure analysis (62%), and using the pre-sidedress soil nitrate test (PSNT) to make supplemental-nitrogen-use decisions. The use of the PSNT was particularly important during 1998, which began very warm followed by heavy rains in June. The fifth and final winter course on managing forages focused on nutrient management and the then-pending Maine legislation, LD1874, an act addressing nutrient management. In addition, the University of Maine Cooperative Extension Nutrient Balancer Computer program, which has been revised as part of this project, was demonstrated. Two additional workshops in Kennebec and Franklin counties were held to provide similar information to dairy farmers in these areas. Information was also summarized in the *New England Farmer*.

The integration of dairy and potato production systems has also been a central focus of this project. During the past year, potato farmers at the Maine Potato Conference and the Central

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Collaborators

University of Maine Cooperative Extension
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Maine farmers

ACE Grant

\$107,000

Match

\$142,492

Duration

1994 to 1998

Project Number

ANE94-20

ME

Project Number

ANE94-20

Maine Potato Conference learned about manure in potato production systems. The results of on-farm research trials, which were all conducted as part of this SARE project, were reviewed at the Maine Potato Conference, including crop and soil nutrient responses to manure application and the supplemental application of fertilizer in manured fields. Best management practices for manure use, including manure testing, calculation of realistic application rates, field selection for application, manure incorporation to reduce volatile loss, and in-season nitrogen (N) testing were discussed.

There have been substantial impacts on a number of Maine farms. Several central Maine potato farms fertilized substantial acreage with manure in 1997 and 1998. One farm fertilized 50 acres with only manure in 1997, saving \$6,000, and increased this to approximately 250 acres in 1998 for a savings of \$25,000. These savings represent only cash savings from fertilizer; long-term benefits from increased soil organic matter and improved soil physical properties are additional. Another producer fertilized nearly 200 acres with manure in late 1997 and reduced fertilizer costs by \$50 to \$75 an acre as a result. Another potato farm is using dairy manure to fertilize rotation crops on nearly 300 acres that had not received manure in the past. This same farm is growing potatoes on fields that historically have been in silage corn fertilized with manure. Several other dairy farm and potato farm

combinations are either evaluating or implementing strategies where the potato farm grows and sells feed to the dairy farm, using the manure from the dairy. These innovative arrangements, and their rationale, were summarized by Lorraine Merrill at the "Ten Years of SARE" conference in Austin, Texas.

This project was also discussed at a regional conference, "Productivity and Conservation," co-sponsored by the Reilly Foundation, NRCS, and CSREES. This conference was held in Baltimore, Maryland and was attended by about 60 people from the northeast region, including extension, NRCS, FSA, and other agency personnel. The goal of the conference was to examine projects that have been successful in protecting natural resources and are collaborative efforts among producers, educators, and agencies. Conference participants, in response to the presentations, developed a list of items that appeared to be common elements of successful collaborative projects on natural resource management. These are being developed into a publication for natural resource professionals, and one project from each of four regional workshops was selected to participate in a roundtable workshop in Washington, D.C. in December of 1997. The results of this second workshop were presented to the secretary and deputy secretary of USDA and other national leaders in agriculture.

Reported December 1998



A Systems Analysis of Organic & Transitional Dairy Production

Summary

This project collected information on the economic, environmental and social costs of organic dairy production and farms in transition to organic. Three areas were analyzed: business management, animal management, and crop management.

Objectives

- ◆ Assess the farm management systems of three certified organic dairy farms, four transitional dairy farms, and one conventional dairy farm.
- ◆ Facilitate the exchange of information from farmer-to-farmer and farmer-to-agricultural professional, particularly Cooperative Extension staff, researchers, and veterinarians.

Key Findings

The farmers in the study found that it was economically profitable to produce milk organically. Farmers can maintain and improve their soil fertility through the annual spreading of manure and natural soil amendments and through crop rotation instead of having to rely on the use of chemical fertilizers.

Homeopathic treatments show great promise as an alternative to antibiotics and other conventional medicines currently used to maintain herd health.

The farms that seem to have the easiest time making the transition to organic production tend to have pasture-based herds with production levels that are average, not high.

Staphylococcus aureus is the most common mastitis pathogen for organic herds, perhaps due to the tendency of cows in organic herds to live longer.

Dairy cow hygiene is the most important management item in organic dairy farms. Organic producers should take extra precautions to minimize new intramammary infections during the dry period and among replacement heifers, the two critical points of entry of mastitis. Special attention should be given to balancing rations for micronutrients such as Vitamin E, selenium, and copper to enhance the cow's immune system.

Due to their increased milk check, the organic farmers are meeting their cost of production and are able to be better all-around managers. This management includes upkeep of facilities and affording new manure-management systems to divert primarily liquid runoff from existing storage.

Methods and Findings

Of the eight study farms that started the project, three were organic, four transitional, and one conventional. During the course of the study, two of the transitional farms became organic, leaving five organic, two transitional, and one conventional. Quantitative information was obtained by collecting detailed records of costs, labor, time, inputs, and production of animal and crop components on each farm. In addition, whole-farm financial analysis was conducted on each farm.

Each year, the participating farmers chose topics to focus on. These topics included large-animal homeopathy, organic feed and forage management, milk quality and udder health, and

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SARE Grant

\$165,000

Match

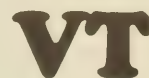
\$131,108

Duration

1993 to 1998

Project Number

LNE93-39



soil fertility management. On-farm technical meetings were organized around each subject, and farmers had the opportunity to meet with 30 to 40 peers who had recently made or were interested in making the transition to organic dairy production. The farmers used these meetings to show their farm and demonstrate a management practice unique to their farm, to discuss their approach to the particular topic, to detail their successes and challenges, and to network with the researchers and project advisors on different management practices.

Topics included large animal homeopathy, forage management in organic production, the use of pastured poultry for parasite management, organic dairy production, milk quality and udder health, soil fertility and stewardship, and new models of cow housing for seasonal milking programs.

This project was generated out of a lack of answers to questions such as: "How much does it cost to produce 100 pounds of milk organically? Is there any connection between feeding a lower energy ration to my cows and a decrease in animal health problems? Will milk production decrease if I feed my cows organically?" To gather this information, monthly visits were done through November of 1996 to each farm. This gave us two full years of data on cropping and animal management, including information on feeding, nutrition, and herd health. During this time, we also completed the economic data collection for 1993 through 1995 on seven of the eight farms. Key findings are:

Business Management: The farmers in the study found that it was profitable to produce milk organically. One farm increased their net profit by 30% from the first to third year of the study; another farm increased by more than 40%. This was due to an increase in the price of milk per hundredweight, a decrease in production expenses, and an increase in non-dairy-farm income.

It is difficult, and perhaps inaccurate, to present the isolated economic findings without the context of the full case studies. Nevertheless, the greatest demand for information is from individuals who want to know whether organic dairy farming is economically viable. The analysis of the farms that made the transition to organic dairy production during the course of our study is probably the most helpful. The farms that seemed to have the easiest time making this transition tended to have pasture-based herds with production levels that were average, not high. These farms were fertilizing their

fields with manure, growing haylage or hay for their forage, relying on pasture for seasonal feed, and rarely had health problems, using antibiotics only a few times a year.

Financially, these farmers were doing well conventionally. One farm under conventional management grossed \$125,000 from 70 cows with a total of 908,000 pounds of milk shipped. The second year they shipped conventional milk for part of the year and then qualified for organic certification and shipped organic for the second half of the year. By the end of the third year, they were shipping only organic milk, receiving \$165,000 from 70 cows with a total of 890,000 pounds of milk shipped.

All of the farms in the study are in Vermont, but their soil type and cropping systems differ. The soil types vary from Vergennes clay (Leicester) to Tunbridge (Chelsea). While six of the eight farms are pasture-based and purchase their grain, two grow the majority of their own feed, including corn, barley, and oats. Seven of the eight farms are family run, while one is managed by a solo operator. The farms vary from 13 to 115 milking cows, with three herds of Holsteins and five of either Jerseys or mixed breeds. The topography ranges from the lowlands of the Champlain Valley to the hill farms of Plainfield and Chelsea to a farm on a high, northern plateau near the Canadian border.

Animal management and herd health: Before this grant, few of the farmers were getting their milk quality tested for somatic cell count, and were not identifying the mastitis pathogens. Working with the Quality Milk Research Lab (Q.M.R.L.) at UVM, the farmers sampled their cows when they dried them off, when they freshened, when they purchased a cow, or when they had a clinical.

The Q.M.R.L. found that *Staphylococcus aureus* is the most common mastitis pathogen, and the researchers hypothesize that this is due to the age of the cows and due to the fact that most organic farmers keep their cows around for more lactations than conventional farmers. This finding has stirred a debate about whether the organic farmers with cows with *Staph. aureus* should treat those cows with an antibiotic when they are dried off. The organic certification standards prohibit the routine use of dry treatment and its use may be prohibited in subsequent years. The farmers are working with the Q.M.R.L. to determine what other management practices might be contributing to the occurrence of *Staph. aureus* and how to control it in the herd,

perhaps by changing pre- and post-dipping solutions, or segregating cows with *Staph. aureus*. Control of mastitis is paramount to maximizing the production and profitability of high-quality milk. Given that organic dairy farmers are prohibited from using antibiotics to treat mastitis, organic dairy farmers must pay more attention to preventing mastitis.

Animal management and feeding and nutrition: The predominant questions for the participating farmers regarding feeding were whether, if you are relying primarily on pasture, how to best supplement energy. If you don't want to stress cows, but you want enough energy, how much feed should cows be getting?

The majority of the organic farmers in the state, and in this study, are grass-based farmers. While most conventional farmers rely on corn silage for energy, grass-based farmers must increase milk production by putting up high quality forages to maintain condition. This is an obstacle for farmers making the transition to organic dairy who are used to the conventional goal of managing cows for production. If a farmer does not grow organic corn silage or soybeans, these feeds are difficult to purchase; farmers must reformulate their ration in order to rely on organic forages and purchased grain.

Crop Management: The predominant issues for the farmers who are making the transition to organic dairy production is how they can maintain fertility without the use of synthetic chemical fertilizers and how to manage weeds in row crops without the use of herbicides. There was an active discussion among the dairy farmers who transitioned into organic agriculture for predominantly economic reasons, and those dairy farmers who believed a farm could only be successful if managed as a system of connecting parts. This discussion led to the topic for the second annual "Alternatives in Animal Health" conference. Supported by SARE, the 1998 conference was called "The Farm as an Organism: Interconnections from the Soil Up."

Impacts

We are writing a detailed publication on organic dairy farming, including comprehensive case studies for each participating farm, technical chapters by the participating researchers, and articles by the participating farmers.

This project has the potential to contribute significantly to the dairy industry in Vermont, and with a transfer of information, to other states. Conven-

tional dairy production is threatened by low milk prices, environmental regulation and liability, and consumer acceptance. While organic grain costs are higher than conventional grain, and while some farmers see a decrease in milk production, farmers estimate that there is a net economic benefit due to higher organic milk prices.

There have been changes the participating farmers have made, as well as changes that have taken place among the farmers that are transitioning to organic and using the project farmers as mentors. For example, one farmer transitioning to organic production started cultivating his corn instead of using a herbicide, and began relying on organic fertilizers and crop rotations instead of synthetic fertilizers. For organic corn production, the farmer now plows in 20 tons per acre of manure in the spring, uses an organic granulated whey fertilizer (5-9-1) at 420 pounds per acres as a corn starter, cultivates the corn three times with a s-tine cultivator, six days apart, and spinner spreads on allis sweet annual red clover at 10 pounds per acre as a green manure crop. Corn is planted for two years, followed by six years of alfalfa and orchard grass.

All of the farmers have increased their knowledge of and use of alternatives to antibiotics, mostly by using more homeopathic remedies. Most of the farmers have the greatest problem with reproductive and udder health. In conventional animal practices, farmers treat reproductive problems with hormones, which are prohibited in organic practice. Mastitis, the most common udder malady, is conventionally treated with antibiotics. Farmers have had success using the homeopathic remedies bella-donna and aconite when the quarter is swollen and cow has a high fever.

Especially noteworthy is the fact that the one conventional farm in the study started using homeopathic nosodes in a controlled procedure directed by the consulting veterinarian. They were so shocked by their success rate that they have transitioned from conventional to homeopathic remedies, specifically for hairy heel wart and calf scours.

Other effects of this project include pasture-management consults and an increase in intensive pasture management, experiments with non-synthetic fly-control strategies, new protocols for sanitizing milking equipment, and using calf nursing to improve cow health and improve milk quality.

Reported June 1998



Optimizing the Use of Grass on Dairy Farms for Environmental & Economic Sustainability

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SARE Grant

\$118,024

Match

\$233,633

Duration

1995 to 1998

Project Number

LNE94-42

Summary

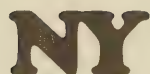
This is a report on the third of three feeding trials and the residual harvesting in the fourth growing season of a three-year experimental project. The project was initiated to develop and validate best management practices (BMPs) for perennial grasses on northeast dairy farms, and to promote increased use of perennial grasses for nutrient and manure management and profitability. In the second feeding trial for this project, dairy cows in midlactation were fed either alfalfa or early- or late-maturity orchard grass in balance rations. Milk production was higher for cows fed early-cut orchard grass. In the third feeding trial for this project, which compared early- and late-maturity grass silage, these silages were fed to dairy cows in early lactation during the winter of 1997 to 1998. Higher dry-matter intake by cows on early-cut orchard grass silage resulted in more milk production. Results indicate that the quality of orchard grass' neutral detergent fiber (NDF) is important in determining dry-matter intake and resulting milk production. A perennial grass harvest was taken in 1998 at the Mount Pleasant experimental site to evaluate the residual effects of nitrogen (N) fertilizer treatments. Reed canary grass averaged 2.3% more crude protein than timothy, agreeing with previous years. Although plots were fertilized with potassium based on soil test of high N-fertilized plots, soil potassium was depleted over years in plots receiving more than 120 lbs N fertilizer per acre. Nitrogen removal with the residual harvest in 1998 was highest for reed canary grass plots receiving no N fertilizer in previous years, while N removal was highest for timothy plots receiving the highest rate of N fertilizer in previous years. For reed canary grass, there appeared to be nitrogen carryover only in the highest N fertilized plots.

Objectives

- ◆ To identify the optimum forage quality of perennial grasses for dairy cows to maximize profitability and to verify results through animal feeding trials.
- ◆ To determine the appropriate harvest management to obtain optimum quality of perennial grasses while maintaining stand persistence.
- ◆ To develop an economic budget to demonstrate the advantages of proper grass and manure management on dairy farms and encourage increased use of perennial grasses.
- ◆ To carry out a case farm study to demonstrate new best management practices for optimum grass management, including harvest management as well as nutrient and manure management.

Project Results

Three fields of orchard grass were established at the Cornell dairy farm in 1994 and are being used for three dairy feeding trials. The second of three feeding trials was conducted in the summer of 1997, and the third in the winter of 1997 and 1998. Orchard grass stands were fertilized with 100 lb of N per acre in the spring of 1997 at green up, and orchard grass was harvested at 57% NDF and stored as silage in Agbags. Orchard grass regrowth also received 100 lb N fertilizer per acre and was



harvested at 63% NDF and stored as silage in Agbags.

In study one, 60 Holstein cows in midlactation (109 ± 49 days in milk initially) were randomly assigned to one of three diets for the ten-week trial. Each diet was balanced to provide NDF equal to .95% of body weight, primarily from forage using SPARTAN (1997). Corn silage (47 % NDF) was set at 20% of the total forage dry matter (DM). Forages studied included alfalfa (ALF), a late cut orchard grass (OGL) and an early cut orchard grass (OGE), all ensiled. Diets were balanced for net energy of lactation (38 megacalories per day) and crude protein CP (4.0 kg per day) with high moisture corn grain and soybean meal and fed as total mixed rations (TMRs).

Forages comprised 53%, 47%, and 44% of total diet DM for ALF, OGE, and OGL based TMRs, respectively. Milk production was higher for cows fed the OGE than for cows on the ALF or OGL TMRs. This was primarily due to a higher dry-matter intake by cows on OGE than on other diets ALF and OGL, respectively. Milk production differences between diets were larger early in the study and in cows less than 60 days in milk (DIM).

In a second study, 50 early-lactation (57 ± 28 DIM initially) Holstein cows were assigned randomly to one of two TMR diets: early-cut orchard grass silage or late-cut orchard grass silage. As in study one, each diet was balanced to provide NDF equal to .95 % of body weight and were balanced for net energy of lactation (38 megacalories per day) and crude protein (4.0 kg per day) with high moisture corn grain and soybean meal. Cows on the early-cut TMR had higher ($P < 0.01$) milk production during the seven-week trial than those on the late-cut TMR. Higher DMI by the cows on the early-cut TMR resulted in more ($P < 0.05$) milk produced than those on the late-cut TMR. Results indicate that quality of orchard grass NDF is important in determining DMI and resulting milk production.

Grass stands (reed canary grass and timothy) at the three sites were used to gather information on optimum N fertilization and harvest management to achieve the desired forage quality. Nitrogen analyses were reported in 1997; fiber analyses are reported here. Grasses were managed to achieve an

optimum fiber content (55% NDF) and a higher than optimum fiber (60%+ NDF). As in previous years, five levels of N fertilization (from 0 to 480 lb) were applied to each species-harvest management combination. The primary difference in fiber content between harvest managements is at the spring harvest. The pattern of first increasing, then decreasing NDF content with increased N fertilization has been consistent over years.

A residual harvest was taken in 1998 to assess carryover nitrogen. Nitrogen fertilizer was not applied in 1998. The yield of timothy was considerably higher than reed canarygrass at all previous N fertilizer rates, except for plots receiving no N fertilization. There was a small but significant interaction between cutting management and previous N fertilization rates.

Again, as in previous years, crude protein content of timothy was consistently lower than in reed canary grass in the 1998 harvest. Across all previous N treatments, reed canary grass averaged 2.3% higher CP than timothy, but species were similar in N content at the highest previous N fertilizer rate. Fiber content tended to be lower in reed canary grass. Nitrogen yield in the residual harvest followed similar trends, as did dry-matter yield, with large differences between grass species. The most N was removed from reed canary grass plots where no previous N fertilizer had been applied. The most N was removed from timothy plots that received the highest rate of N fertilization in the past. From a nitrogen management standpoint, reed canary grass appears to be superior to timothy.

Twelve farms that use grass for dairy cattle were sampled in 1997. Farm inputs were collected, including crop yields, crop quality, off-farm feed inputs, soil tests, dairy manure analysis, and the amount of commercial fertilizer and manure applied to each field. There were 382 farm fields on these farms for a total of 3,692 acres. Crop enterprises were 1,193 acres of corn (32%), 2,137 acres of hay (58%), 169 acres of small grains (5%), and 193 acres of improved pasture (5%). Analysis of data collected from these farms will be completed before the project termination date.

Project Number

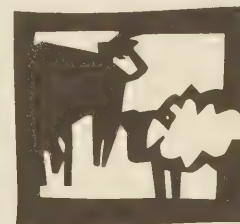
LNE94-42

Dissemination of Findings

Grass management presentations at extension meetings to discuss results obtained in this study and to promote the effective use of grasses were held 21 times at 18 locations around New York with more than 1,000 people attending. There were also presentations at scientific meetings of feeding trial data, and forage quality results from grass sites were presented at the following meetings and published as Cherney, D.J.R., J.H. Cherney, and L.E.

Chase, 1998, "Lactation performance of Holstein cows fed orchardgrass silage." J. Dairy Sci. 76(Suppl. 1):207. These two authors also co-edited a book for CAB International published in November, 1998 called *Grass for Dairy Cattle*. The book highlights the importance of grasses in grazing and nutrient management, particularly in relation to the dairy industry, and uses some of the results from this study.

Reported January 1999



Increasing the Sustainability of Dairy Farms by Improving Persistence of White Clover in Pastures

Summary

White clover in northeastern dairy pastures is known to improve forage quality and yield and decrease or eliminate the need for nitrogen (N) fertilization. Unfortunately, white clover survival can be a problem. This project conducted field trials to determine the seasonal growth pattern and times of stress for white clover in grazed pastures as well as the effect of moderate and heavy grazing pressure on white clover performance.

Objectives

- ◆ Increase the sustainability of dairying and pasture-based agricultural systems in the Northeast through better management of white clover, a key pasture species.
- ◆ Detail the seasonal growth pattern of white clover in order to understand when it is most vulnerable and how it survives the stresses of pasture.
- ◆ Evaluate alternative varieties (cultivars) in terms of productivity and persistence.
- ◆ Test different grazing managements for effects on the first two objectives.
- ◆ Distribute information about the pasture ecosystem and superior white clover varieties to farmers who could make better use of pastures.

Key Findings

White clover in the Northeast is most vulnerable and most stressed in the summer, especially after drought.

Current recommendations for orchard grass and white clover pastures are about optimal.

Farmers making pasture seedings should be experimenting with improved white clover cultivars, especially those with virus and drought resistance. With pasture renovation costs calculated to be about \$40 an acre, finding and growing better white clovers is economically sound.

Overgrazing of orchard grass may encourage weed encroachment into pastures.

Methods and Results

Field trials were conducted on Tom Miller's dairy farm at Dryden, New York from 1993 to 1995 to determine the seasonal growth pattern and times of stress for white clover in grazed pastures as well as the effect of moderate and heavy grazing pressure on white clover performance. About 45 dairy cows were rotationally stocked on 50 acres of orchard grass-white clover pastures that were seeded in 1988. The soils are Phelps and Howard gravelly loams on rolling topography with moderate-to-good drainage. The climate is typical of central New York.

From 1994 to 1997, white clover cultivars and experimental lines were evaluated under grazing on the Miller farm and at the NRCS Plant Materials Center at Big Flats, New York. From 1996 to 1998, Cooperative Extension information describing the pasture ecosystem was prepared as a basis for improving farmer and student understanding of pasture management. Finally, in 1997 and 1998, enterprise budgets of pasture renovation with improved white clovers were prepared to summarize the economic implications of the field work.

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Soil Conservation Service

SARE Grant

\$12,584

Match

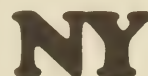
\$51,798

Duration

1994-1997

Project number

LNE94-45



The ecological summary of this work identified five principles that can be demonstrated in a typical pasture in the Northeast: 1) everything that is organic is food (energy flows), 2) nothing is wasted (matter circulates), 3) there is a premium on protecting the soil, 4) there is always a substitute (biodiversity), and 5) there are always animals under natural conditions. These principles can be applied to good pasture management as well as general education about the ecological basis of sustainable agriculture.

Seasonal Growth

The seasonal growth pattern of white clover in rotationally grazed pasture showed levels of leaf density and bud activity to be relatively low in the spring but increasing through the season. Mortality of complete white clover plants was very low throughout the season, although stolon decay and break-up into separate plants was observed. White clover plants were not smaller or less complex in branching pattern in the spring than later in the season. However, at the end of a hot and dry period in the summer of 1995, white clover plants occupied a smaller area and were less complex than plants in the spring. This contrasts with studies in milder climates where plants were smaller and less complex in the spring.

Reduced size and complexity is interpreted as a response to stress. Thus, summer drought appears to be the most important stress for white clover in our climate. We recommend that farmers decrease grazing frequency and closeness for a short period after a summer drought in order to maintain the productivity and persistence of white clover.

In contrast to white clover, the leaf-density and tiller-density of orchard grass and bluegrass decreased toward the end of the growing season. After the drought period of 1995, the leaf density of dandelion and other weeds was higher than they had been in the spring.

Cultivar productivity

The most widely sown white clover cultivar in the Northeast is 'California Ladino' (or simply 'Ladino'). Winter survival often has been associated with place of origin and increased stolon production. Thus we compared 'Ladino' to cultivars that were supposedly more stoloniferous or came from a colder climate. Twelve cultivars and breeding lines

(including 'Ladino') were also established with orchard grass in ungrazed research plots at the NRCS Plant Materials Center at Big Flats, New York in 1995. The results do not clearly identify a cultivar better than *Ladino*. However, they do show there is a good possibility of improving this species by giving it more productivity in dry summers and increasing its resistance to virus diseases. Those changes would improve pasture yields and forage quality and reduce the risk of low pasture production.

Grazing Management

Survival and recovery of white clover following summer drought was identified as an important problem. Increasing grass tiller density by more frequent spring grazing has helped reduce summer stress in white clover under conditions in New Zealand. Apparently, the increased shading and lower soil temperatures help during summer drought. The work in New Zealand was done with perennial ryegrass as the companion grass species.

Grass tiller density is known to show an inverse relationship with tiller mass. Thus, more frequent or closer grazing should increase tiller density. In 1993 we tested this hypothesis with orchard grass by grazing the test plots every seven days, which was about three days ahead of the farmer. In 1994 and 1995, we grazed at a starting pasture mass of 2100 kg/ha compared to the farmer's starting mass of about 2400 kg/ha. The different grazing systems were applied only through June.

Our results showed that we did not increase orchard grass tiller density. In fact, the most aggressive system in 1993 appeared to weaken the orchard grass and allow weed invasion of the test areas. White clover leaf numbers were increased by more aggressive grazing, and following the 1995 summer drought, white clover recovered more quickly on the plots that had been grazed more frequently in the spring. Orchard grass is apparently weakened by grazing before it has about 2400 kg/ha of available forage. This weakening can benefit white clover if it is stressed by drought, but one must manage to optimize the pasture, and not just one species. We concluded that the present recommendations for grazing white clover and orchard grass pastures should not be changed.

Dissemination of Findings

Many of the practices of sustainable agriculture can be understood and refined in terms of ecological principles. In fact, some have argued that the way to make agriculture more sustainable is to make agroecosystems more like natural ecosystems. The grazed pasture is a relatively natural agroecosystem. We prepared a publication, "Concepts of Sustainability and the Pasture Ecosystem," which identified five ecological principles that can be demonstrated in a typical pasture in the Northeast.

The definitions of sustainable agriculture, the pasture food web, the biomass pyramid, the carbon cycle, and species composition are presented for new as well as experienced visitors to the pasture ecosystem. The publication has been used with a laboratory field trip for the introductory course in sustainable agriculture at Cornell University.

Economic Analysis

The economic questions raised by the field work in this project boil down to the costs and benefits of

improving the white clover component of orchard grass pastures in the Northeast. Our results indicate that reseeded improved cultivars may be more successful than attempting to refine the grazing management system. Thus we prepared enterprise budgets for pasture improvement including reseeded. We did not collect data on the likely responses, but have chosen to look at cases where such practices would increase yields by one or two tons per acre with 1.5% higher crude protein and 5% less neutral detergent fiber than the unimproved pastures. Those numbers are consistent with results from other studies done by NRCS or that have been reported in the literature. The Cornell FORVAL model was used to calculate the value of the pasture produced given its forage quality and the market prices of alfalfa and timothy hays that would be used to replace the pasture should it not be available.

Two scenarios were considered: low feed prices (\$100 a ton for alfalfa hay) and high feed prices (\$200 a ton for the same hay). At low feed costs, increasing the yield and quality of a northeast pasture by planting an improved white clover cultivar would increase the value of the pasture produced from \$120 to \$130 an acre. With the expense of renovation being about \$40 an acre, pasture reseeding would be a profitable practice.

Reported June 1998

Project number

LNE94-45



Fescue Endophyte Research Study

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 Maryland Department of Agriculture
 Farmers in Maryland, Pennsylvania,
 and West Virginia

SARE Grant

\$9,632

Match

\$7,310

Grant Period

1996 to 1998

Project number

1NE95-52



Summary

Farmers in the Appalachian region have planted fescue for years because of its hardiness. However, high levels of a parasitic fescue endophyte, *Acremonium coenophialumas*, can cause production losses. When endophyte levels are 60% or higher, it has been shown that dairy cattle, breeding mares, meat animals, and young animals have a higher risk of breeding or production losses. This study is aimed at improving the viability of small farm operators and increasing the overall health of the region's livestock population.

Objectives:

- ◆ Test half the farms with fescue pastures in Allegany County for fescue endophyte.
- ◆ Of the herds found to be grazing infected fescue, test 60% to determine herd health by the end of the project.
- ◆ Use the results of the Fescue Endophyte Research Study as a basis for making sustainable management recommendations to the agricultural community.
- ◆ Conduct an agricultural demonstration field day to share the Fescue Endophyte Research Study results with the farming community.
- ◆ Conduct a workshop for conservation groups, government agencies, and sport organizations to share the results of the study and its correlation to wildlife habitat.

Key Findings

Many of the fields tested (68%) have endophyte levels at 60% or higher.

At a 60% or higher endophyte level, dairy cattle, breeding mares, meat animals, and young animals have a higher risk of breeding or production losses.

Because of the variety of sites and differing effects of the fungus on livestock classes, herd health was determined too large a variable to adequately measure.

Findings and Results

A total of 85 fields have been tested on 31 different farms in the tri-state area to date. The testing period was from June 1996 to September 1996, in July of 1997, and in July of 1998.

The fields with "hot" pastures have been identified. Farmers have been notified and provided with recommended options for managing and improving pasture quality.

A fact sheet with our study results, general guidelines, and recommendations for treatment has been developed for public information.

A program was given to 30 farmers in a tri-county region around Morgantown, West Virginia, in May of 1997. Results of the 1996 testing period were shared and treatment methods were discussed. A display of the project was set up at the "Grazing in the Northeast" symposium that was attended by over 200 farmers, researchers, and specialists. A workshop was held in November of 1997 to share project results and recommendations with more than 50 farmers and landowners in the project target area.

Site Information

The project was accomplished in the Appalachian Mountain region and involved two physiographic provinces that varied from shallow and shaley on the ridges to deep and fertile in the flood plains and stream terraces. Within Allegany County, where a majority of the testing was done, the eastern part receives 10 to 15 inches less precipitation per year than the Allegheny Plateau to the west.

Economic Analysis

Since testing showed a 60% or higher endophyte level, animal health in certain classes of livestock was at risk. In particular, dairy cattle, breeding mares, meat animals, and young animals increased their risk of breeding and production losses. This risk could be mitigated with pasture management, maintaining a balance of grass and legumes, frost seeding or drilling clovers every two to three years, management intensive grazing, and removing cows, mares, and ewes from infested pastures during peak breeding times.

Reported September 1998

Project number

LNE95-52



Expanding Profits for Sheep Production through Intensive Pasture Management

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Vermont Dept. of Agriculture, Food,
and Markets
Vermont Lamb Promotion Board
Vermont Sheep Breeders Association

SARE Grant

\$82,427

Match

\$84,689

Duration

1995 to 1998

Project number

LNE95-54



Summary

Vermont researchers and sheep producers are using a cooperative learning and outreach model to investigate the financial viability of pasture-based sheep production.

Objectives

- ◆ Investigate the economic feasibility and production capacity of finishing lambs on pasture.
- ◆ Test the applicability of management systems, specifically Holistic Resource Management (HRM) and the Standardized Performance Analysis (SPA).
- ◆ Identify and evaluate potential alternative lamb markets as an addition to, or a supplement for, commercial lamb sales.
- ◆ Implement a model for cooperative research and information dissemination.

Results to Date

Several farms showed a trend of increasing average daily gain each year as they learned how to better manage growing lambs on pasture.

There were large differences between farms in costs, income, and production. The average feed cost per ewe on farms ranged from \$13 to \$220.

Increasing the intensity of grazing management can lower spring and summer feed costs.

Increased production and improved management of stockpiled fall and spring grazing can significantly lower the quantity of winter hay fed per ewe.

Close attention to forage quality of hay and pasture, combined with close attention to ewe body condition score, can help decrease feed costs by supplying high quality and high quantity forage to ewes only when they need it.

Carefully timing when ewes lamb to match seasonal fluctuations in the quality and quantity of forage can significantly decrease the quantity of hay and can decrease or eliminate the need for grain.

Method and Results

This project is starting with case studies of Vermont sheep producers currently experimenting with pasture-based systems. The number of participating farms increased from six to ten in 1997, and in 1998 included 620 breeding ewes on ten farms in Vermont and New Hampshire. On each farm we measured pasture species composition, soil fertility, and forage quality at least once each year. We weighed lambs at least twice each year to measure average daily gains, and we collected flock production and financial information on an annual basis using the SPA (Standardized Performance Analysis) program.

Pasture species composition was measured each year in two pastures on each farm. Species composition changes occurred during the study on many farms due to changes in pasture management strategies. On one farm, clover content increased due to intensive grazing management. Another farm showed an increase in clover and a decrease in weed species because of improved soil fertility and grazing management. One farm was preventing parasite infection by allowing the pasture to grow taller, both pre- and post-grazing; in one field, this decreased the clover content due to shading from 14.5% to 1.2%. Another farm that was trying to improve pasture productivity by decreasing weed

species was able to decrease the weeds from 49% to 20.3% by changing grazing techniques.

Soil fertility was tested in at least two pastures on each farm. Soil on many of the farms is acidic and low fertility. This is probably because the majority of the farms are hill farms that were abandoned as dairy farms ten to thirty years ago. One management method being used by several producers to improve soil fertility is wintering livestock out and feeding out hay on pasture. Over two years, one producer was able to increase the soil phosphorous levels by 11% and potassium levels by 10% on one field and by 21% and 36% on another field using this technique. On another farm, soil organic matter was increased from 5.7% to 9.7% with intensified short-term grazing on one field, and from 7% to 10.1% on another field by grazing and composted manure applications.

Forage quality was tested once each year. Crude protein varied from 13% to 28% with stage of maturity and species composition.

Lambs were weighed at least twice on each farm during the growing season, allowing us to track average daily gain from farm to farm and from year to year. Rates of gain varied from 0.7 lb. per day to 0.35 lb. per day due to differences in breeding and in management style. As expected, rates of gain on most individual farms tended to decrease as lambs got older and after weaning. On one farm, the average daily gain dropped to below 0.1 lb. per day in the fall in older lambs. Several farms showed a trend of increasing average daily gain each year as they learned how to better manage growing lambs on pasture. One farm stopped feeding grain and delayed weaning, yet the average daily gain increased from 0.34 lb. per day to 0.49 from 1996 to 1998 due to improved pasture management.

All the participating producers are using the SPA computerized record keeping system to track finances and production. Several of the producers have attended holistic management courses and are implementing some of those principals on their farms.

In 1998, we held a lamb carcass evaluation and meat cutting workshop on the campus of the New England Culinary Institute in Montpelier. Three lamb carcasses were evaluated—one that was primarily grass finished, one was primarily grain finished, and the last was finished on a mixture of grass and grain. The class compared the differences between the three methods of production and learned what attributes the market was looking for.

Economic Analysis

Annual financial and production data was collected each year on each farm using the SPA program. Data collected and to be analyzed from SPA programs include feed cost per ewe, return on assets (cost basis), return on assets (market basis), gross revenue per ewe, gross revenue per acre, total operating expenses per ewe, total operating expenses per acre, income after expenses per ewe, income after expenses per acre, lambs weaned per ewe exposed, average weaning age, pounds of lamb per ewe exposed, acres per exposed ewe, pounds of lamb per acre, and pounds of feed per breeding ewe.

From the information gathered, we now can recommend different management techniques. This includes pasture and lamb management, as well as different marketing systems. Some of the marketing systems involve organically grown lamb, lambs sold to a feeder, lambs sold to a restaurant and lambs sold to the freezer trade.

Reported December, 1998



Efficacy Evaluation of Homeopathic Nosodes in Organic & Conventional Dairy Production

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SARE Grant

\$161,026

Match

\$54,213

Duration

1997 to 2000

Project number

LNE97-86

Summary

Bovine mastitis continues to be the most costly disease of dairy cows. Unfortunately, the use of antibiotics has not proven totally effective in curing existing udder infections, and the use of antibiotics increases the risk of residues in milk and dairy products.

An abundance of anecdotal information and case histories strongly suggest that homeopathic remedies effectively prevent mastitis. This project is a controlled research trial that can offer some strong credibility in the use of nosodes for mastitis and calf scours.

Objectives

- ◆ To evaluate homeopathic nosodes in the prevention and treatment of bovine mastitis and calf scours.
- ◆ To compare economics of homeopathic therapy with conventional practices and to measure changes in milk quality and yields using homeopathic remedies.
- ◆ To document the use of homeopathy on Vermont dairy farms.
- ◆ To facilitate information exchange—farmer-to-farmer and farmer-to-agricultural-professional.

Methods and Results

Bovine mastitis is not only costly, it also has detrimental effects on milk quality and composition. Conventional methods of mastitis control—primarily antibiotics—have effectively reduced the prevalence of contagious pathogens such as *Staphylococcus aureus* and *Streptococcus agalactiae* among dairy cows. Environmental pathogens such as *Escherichia coli* and *Streptococcus uberis* have emerged as the most common pathogens over the past several years in the majority of dairy herds.

Homeopathic nosodes are an alternative for the prevention and treatment of bovine mastitis. Nosodes function similarly to conventional vaccines. They have the potential to increase the natural resistance mechanisms of the cow to prevent establishment of new udder infections and possibly to cure existing infections.

This research project was initiated in September, 1997 with the enrollment of 11 dairy farms (for a total of over 1,000 lactating cows) to evaluate nosodes against mastitis and calf scours. The farms use conventional and organic production practices and range in size from 20 cows to 250. Some of these farms use an intensive rotational grazing system six months out of the year and others have a confinement system year round.

A mastitis nosode was prepared commercially from common mastitis pathogens isolated from cows within the cooperator herds. Each cooperator herd was divided into two treatment groups that were balanced for lactation number, days-in-milk, and for udder health based on somatic cell counts (SCC) from composite milk samples. As a double-blind experimental design, only the consulting veterinarian knows which treatment group received the placebo or the nosode.

The prevalence and incidence of mastitis is being monitored during the entire trial by bacteriological and cytological testing of quarter milk samples from all cows at calving, 30 days post-calving, at dry-off, from all cows that develop clinical mastitis prior to treatment, and from cows 30 days

post-treatment of clinical mastitis.

Efficacy can only be determined after termination of the trial in January of 2000. Through November 1998, over 15,000 quarter milk samples had been tested by bacteriological culture and for SCC. We are analyzing these data to compare Group A and Group B within each herd, without knowing individual treatments (placebo or nosode).

Research has documented how clinical mastitis negatively affects total milk yields and milk quality. It costs the American dairy industry more than two billion dollars annually and each clinical mastitis episode costs a farmer more than \$100.

The NOFA office is initiating an economic study for the purpose of creating benchmarks for the costs of producing organic milk. We will be collecting economic numbers for a whole calendar year using the services of Agrifax (Yankee Farm Credit) and reporting the averages of the ten to fifteen farms involved. Of the eleven farms in the nosode study, five will be participating in this economic study. Though this is not targeting the costs and potential savings using homeopathy, it is information that is needed. These benchmarks will help an organic operation to set goals and compare their costs to some averages, will give a transitioning farmer some useful information as changes are made, and will give loan officers much needed facts and figures when working with an organic operation.

The farms in this study are visited on a monthly basis. During these visits, anecdotal information is collected regarding herd health for the purpose of building a collection of on-farm experiences that can be shared with the dairy community. A few of the farmers in the study are not trying other homeopathic remedies aside from what is being administered to the animals for this project. The ma-

jority are using homeopathic remedies routinely and are documenting the outcome of each health incidence.

One of the homeopathic products is a nosode that deals with foot rot in cattle. This remedy has had success on numerous farms. Another remedy commonly used on dairy farms is Pulsatilla, which is good for cows that are having problems showing heats or breeding back. One farm gives it to their cows after calving to make sure that they are cycling for the next breeding.

Homeopathy means learning to be an observer, to recognize subtle messages coming from the animals, and to build up their immune system based upon that information. This is a skill that has been lost with the magic-bullet cures (that are no longer working so magically) available on the market today.

Use of homeopathic medicines is increasing but can be confusing and often frustrating early in the learning curve. Luckily, there have been study groups forming in different regions of the state giving people the opportunity to understand how homeopathy works and to share their experiences with others. People attending are veterinarians, dairy farmers, sheep and goat farmers, and research and Cooperative Extension people.

This study can also help us to document the use of other homeopathic remedies on farms and supply farmers and resource people with more information on how different remedies are used successfully. The economic analysis will also help farmers as they attempt to produce a cleaner, healthier product. We plan to show how a healthier cow needs fewer visits from the veterinarian, lives longer, and how the volume of milk can increase as quality improves.

Reported December 1998



Eastern Gamagrass: Determining its Feasibility as a Forage Crop for the Northeast

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SARE Grant

\$108,252

Match

\$129,180

Duration

1997 to 2001

Project number

LNE97-96



Summary

Eastern gamagrass is a perennial warm season grass which can be used for hay and haylage in managed pastures. This project is investigating the potential for eastern gamagrass to replace corn as a forage or silage crop on dairy farms.

Objectives

- ◆ Evaluate the adaptability and yields of eastern gamagrass grown on a variety of soil types.
- ◆ Evaluate the compatibility of eastern gamagrass grown with several nurse and companion crops.
- ◆ Evaluate the forage quality of eastern gamagrass grown at the USDA-NRCS Big Flats Plant Materials Center, Corning, New York.
- ◆ Conduct on-farm feeding trials comparing eastern gamagrass with corn silage as a significant portion of a dairy ration.
- ◆ Assess the on-farm economic implications of utilizing eastern gamagrass as a significant component in a dairy ration compared to corn silage.

Method and Findings to Date

Eastern gamagrass is a highly productive, palatable, and digestible forage which may have use on dairy farms. Its use on steeper slopes instead of corn silage will reduce soil erosion and its associated water quality problems.

For this study, the 'Pete' cultivar of eastern gamagrass was established on twelve different sites including eight farms and four teaching and research facilities within nine counties in New York state. Ten of the sites were in corn silage the year before.

The soils varied at each site, and in most cases more than one soil type was represented in each of the fields. Two of the sites were established in 1997 and survived a rather mild winter with no frost heaving or winter injury. Seventeen different soil types were identified from soil maps and on site investigations.

Due to the large crowns, eastern gamagrass is planted in 30-inch to 36-inch rows to facilitate machinery harvest. Eastern gamagrass is seeded with a corn planter at a depth of an inch to an inch and a half. A seeding rate of 15 lbs. per acre was used in 1998, up from 10 lbs. an acre in 1997, to increase competition from weeds and to facilitate cultivating. The use of 2,4-D and cultivation was necessary for weed control since at this time no residual herbicides are registered for this crop.

In order to determine the value of eastern gamagrass grown in the Northeast, forage quality samples were taken on a mature stand of eastern gamagrass 'Pete' at three first-cutting dates with three second-cutting intervals in 1997 and 1998. A total of 270 forage samples were taken each year to be evaluated for percent: crude protein, (CP), Neutral Detergent Fiber (NDF), Acid Detergent Fiber (ADF), lignin, digestible NDF and In Vitro True Digestibility (IVTD).

Companion plantings were investigated to reduce erosion during establishment and to reduce frost heaving problems. Companion plantings of five legumes and oats were established in subplots at all sites immediately following cultivation at the end of July to early August. The legumes were white clover, red clover, alfalfa, birdsfoot trefoil, and black medic. Evaluations were made on eastern gamagrass for population, height, and tiller number, and the companion crops were evaluated for percent cover, weed control, height, and leaf number. Each plot was evaluated for total cover.

Biomass measurements were made of the oats the first year and for the legume covers the beginning of the second. The gamagrass was cut for biomass measurement the second year. In the plantings established in 1997, the white clover and birdsfoot trefoil were the most persistent. At the Morrisville site established in 1997, several perennial cool season grasses were established after cultivation, but all were too competitive for the gamagrass the following spring. Cereal rye was tried and is worthy of further investigation.

The oats established very well and provided such intense mulch cover that the gamagrass plants delayed going dormant. This had a negative impact on survival. The potential for oats to be used as a mulch to prevent frost heaving, reduce erosion, or on well-drained soils to be harvested as a greenchop seems possible. Studies on later planting dates for the oats and reduced seeding rates are underway. The total cover on most sites that included the gamagrass, companion plants, and weeds resulted in 90% cover going into the winter,

which would provide adequate soil erosion control. On extremely steep sites, especially in areas of concentrated water flows, erosion can be a problem during early establishment, and no-till methods may need to be investigated.

Reproductive and vegetative tillers of seven different eastern gamagrass accessions were sampled to look at genotypic and morphologic differences. Preliminary findings from 1997 data for NDE, ADE, and IVTD have shown significant differences between accessions and planting dates for both reproductive and vegetative tillers. The information obtained from this study will be used in a computer model to decide on a gamagrass-based dairy ration to test with animal feeding trials.

Reported January 1999



Controlling Pests of Pastured Livestock on Organic Farms

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Collaborators

University of Vermont
Area dairy farmers

SARE Grant

\$32,590

Match

\$35,292

Duration

1998 to 2000

Project number

LNE98-104

Summary

This project, conducted on three organic livestock farms, will evaluate herbal treatments for controlling internal roundworm parasites of pastured dairy calves, ewes, lambs, and kids, and will explore the effect of multi-species grazing on fly disturbance among dairy calves.

Objectives

- ◆ Evaluate herbal methods of controlling intestinal parasitic roundworms of pastured dairy calves, kids, ewes, and lambs on organic farms.
- ◆ Evaluate mixed-species grazing of chickens with calves to reduce fly numbers on organic dairy farms.

Abstract

Most pasture-based dairy farmers have changed from raising calves indoors or in outdoor hutches to raising them in groups on well-managed pasture. They do this to decrease labor demand and feeding costs, and to develop animals that use pasture forage efficiently and perform well in a grazing herd. Raising calves on pasture, however, requires control of intestinal parasites, especially roundworms, and flies. Kids and lambs traditionally have been raised on pasture, so these problems are not new to goat and sheep farmers. Organic pasture-based farmers need effective cultural methods of controlling these pests, because synthetic dewormers and fly controls are prohibited.

This research will evaluate herbal treatments for controlling roundworms in pastured animals and provide an evaluation of reducing the fly disturbance of pastured dairy calves by multi-species grazing of calves with laying hens. The results will help farmers produce organic livestock and enable them to increase farm profitability. Livestock production on pasture reduces soil erosion and surface and ground water pollution, especially when done organically, because no synthetic fertilizer or pesticides are used.

Approved for funding March 1998



Nutrition & Management of Dairy Sheep & Goats on Pasture

Summary

This project will determine the optimal level of concentrated supplements to feed high-yielding dairy sheep and goats that are grazing intensively managed pasture. The project, which will be conducted on two commercial farms, responds to the increasing number of sheep and goat dairies in northern New England, and to strong producer interest in data on optimum supplements.

Objective

- ◆ To determine the optimum level of a formulated complete concentrate supplement to feed high-yielding dairy sheep and goats grazing intensively managed pastures.

Abstract

Over the past ten years, the number of dairy sheep and goat farms operating as commercial agricultural enterprises in New Hampshire and Vermont has been increasing. The growing demand and price for sheep and goat milk cheeses, combined with the availability of East Friesian dairy sheep genetics and the use of high-quality, intensively managed pastures as the major forage source, have made these alternative enterprises economically feasible and sustainable.

However, sound research on supplemental feeding of dairy sheep and goats on high-quality, intensively managed pastures is not available. The need for research to provide this data has been identified as a high priority by producers in New Hampshire and Vermont.

This will be a three-year project conducted on two farms, one in New Hampshire and one in Vermont.

This proposal addresses a management question that farmers, researchers, and extension personnel have identified as a priority for small farmers, not only in New Hampshire and Vermont, but throughout the Northeast.

Approved for funding March 1998

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Collaborators

Area farmers
University of New Hampshire
Cooperative Extension
University of Vermont Cooperative
Extension
USDA-NRCS

SARE Grant

\$151,190

Match

\$77,868

Duration

1998 to 2001

Project number

LNE98-108

NH



Use of Hoop Structures for Growing & Finishing Swine on the Delmarva Peninsula

Coordinator

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Collaborators

University of Maryland College Park
University of Maryland Eastern Shore

SARE Grant

\$32,000

Match

\$129,200

Duration

1998 to 2001

Project number

LNE98-111

Summary

This project will compare growing and finishing swine in a modern confinement facility with growing them in hoop structures, a new, alternative, low-cost housing system. Participants will analyze the economic and environmental performance, including swine growth, carcass characteristics, incidence of parasites, cost of production, profitability, air quality, and nitrogen and phosphorus leaching.

Objectives

- ◆ To assess growth performance and carcass characteristics, as well as the health and the cost of production for growing and finishing swine raised in a low-cost, alternative type of housing called a hoop structure, and to compare these factors with swine raised in a modern confinement facility.
- ◆ To compare air quality in the hoop structure and a modern confinement facility.
- ◆ To determine if, and the extent to which, nitrogen and phosphorous leach from the manure pack under hoop structures.
- ◆ To determine if microorganisms and parasites accumulate in the hoop structure.

Abstract

One thousand, nine hundred and twenty 50-pound pigs will be grown and finished in either a hoop structure or a modern confinement facility. The hoop structure will have two lumber side walls that are each approximately five feet tall. An arched metal frame will be inserted into the posts and will be covered with a polyethylene tarp. The enclosure will have an earthen floor and will be deep-bedded with straw. The curtain-sided confinement facility to be employed has slatted concrete floors and is serviced by an under-floor flush system that carries manure to a lagoon.

Average daily gain, feed consumption, and feed conversion efficiency will be assessed. The health of the animals will be monitored and slaughter checks will be performed. Hogs will be slaughtered at an average body weight of 240 pounds and carcasses will be evaluated. Costs of production and profitability will be calculated for each type of housing. Concentrations of various gases in the air of each building will be determined. Nitrogen and phosphorous levels will be determined at different depths in the soil under the hoop structure. The soil and feces will be analyzed for microorganisms and parasites.

Data generated from this project will help determine if hoop structures are an effective, economically viable, and environmentally friendly method of housing growing and finishing hogs.

Approved for funding March 1998



Creating a Farmer-Owned, Value-Added Production & Processing Facility for Dairy Farmers in Central Pennsylvania

Summary

In response to producer interest in creating value-added specialty dairy products, this project will explore the potential for creating a farmer-owned production and processing facility in Union County. The goals are to improve the economic viability of dairy farms and to enhance the quality of life.

Objectives

- ◆ To assist local farmers to enhance the sustainability of their farm operations.
- ◆ To respond to the interest of local farmers in expanding their opportunities to market value-added products.
- ◆ To educate local farmers as to the potential for marketing value-added products.
- ◆ To explore the feasibility of establishing a value-added dairy foods processing facility through a farmer-owned cooperative.

Abstract

Currently dairy producers are facing severe fiscal challenges in Union County, Pennsylvania as well as throughout the Northeast. A survey commissioned by the Union County Commissioners ("Strengthening Union County's Agricultural Industry," October 1997) indicated that there was significant support among the dairy producers within the county for creating value-added specialty dairy products, especially cheeses and ethnic products for urban markets.

This project will explore the potential for creating a farmer-owned, value-added production and processing facility for dairy farmers in Union County, Pennsylvania and neighboring counties. A steering committee of 11 individuals representing Pennsylvania State University, the Union County Chamber of Commerce, Union County Planning Office, Union County Conservation District Office, USDA Rural Business Cooperative Service, Pennsylvania Association for Sustainable Agriculture, and local dairy farmers has been strategically assembled to manage this project.

The project directly addresses two of the goals established by the SARE program: sustaining the economic viability of farm operations, and enhancing the quality of life for farmers, rural communities, and society as a whole. The project will further serve to educate dairy producers as to the potential for creating value-added dairy foods through a local dairy producers-owned cooperative.

Approved for funding September 1998

Coordinator

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Collaborators

Pennsylvania Association for
Sustainable Agriculture (PASA)
The Pennsylvania State University
Cooperative Extension System
Union County Chamber of
Commerce
Union County Conservation District
Union County Planning Office
USDA-Rural Business Cooperative
Service

SARE Grant

\$40,000

Match

\$10,745

Duration

1998 to 1999

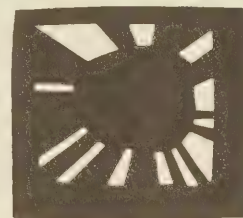
Project number

LNE98-99





education



Water Conservation on the Woodvale Farm

Summary

Woodvale Farm, located at the University of Rhode Island, is an educational farm committed to practicing and teaching sustainable methods. However, it has been hampered by a chronic annual water shortage. Some years the crisis became so bad that the farm implemented a “no water usage” rule for its classroom and two staff houses that rely on the farm’s well water. Because the health of livestock was a priority, the gardens frequently were underwatered and crop yields suffered. This project allowed Woodvale to explore ways to protect and conserve its water supply, and helped improve the resource management component of the farm’s educational curriculum.

Objectives

- ◆ Implement new methods to conserve water at Woodvale Farm.
- ◆ Educate children about the importance of water conservation and its methods.

Key Findings

Several automatic waterers for livestock, two drip irrigation systems, and a roof water rain catchment system have been installed on the farm. These water saving devices have resulted in a substantial reduction in labor costs, improved crop yields, and a marked difference in water consumption levels for the farm.

This water conservation system is now a part of the regular Woodvale Farm educational curriculum. Staff is trained to operate the drip systems, teach about water conservation, and lead groups on a tour of the farm’s water system, including the surrounding wetlands.

The new water system at Woodvale Farm is especially suitable for small-scale growers and home gardeners. The impracticality of automatic waterers and drip irrigation for large-scale growers lies primarily in the high initial costs. The use of a drip system, however, can also be incompatible with mechanical cultivation.

Results

One of the difficulties in quantifying water usage on the farm is the number of variables involved—rainfall, temperatures, livestock and crops with different needs, and varying water conservation habits among the staff. Visitors also affect water usage: there are two public restrooms, a drinking fountain, and a kitchen with a dishwasher for program use. Program-related consumption was measured along with livestock and garden use.

While our statistics concerning water consumption do not definitively indicate a substantial savings, the benefits in labor and time savings are clear. Averages taken in the months of May and June record the hours spent each week watering the gardens and livestock before and after implementing the water conservation system. In 1995, this average was 25 hours a week; in 1997 it dropped to 15 hours a week; in 1998 this task consumed only two hours a week.

This gradual reduction in labor parallels the installation of the various components of the water system—automatic waterers for livestock were installed in 1997, and drip irrigation sys-

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Collaborators

University of Rhode Island Cooperative
Extension
USDA Natural Resource Conservation
Service

SARE Grant

\$3,396

Match

\$880

Duration

1994 to 1998

Project number

LNE94-48

RI

Project number

LNE94-48

tems were installed in 1998.

These visible, accessible devices are suited to a resource conservation curriculum, and are a valuable teaching tool for any educational institution that intends to teach about sustainable agriculture or water conservation.

Economic Analysis

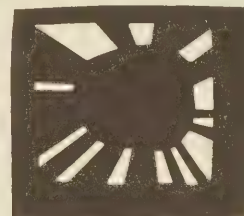
The methods chosen for the project were relatively expensive to purchase and install. The automatic waterers and drip irrigation system required a high initial investment, but the benefits in labor and water savings outweigh the initial costs. The labor and materials for this project totaled \$4,276.

Before installation of these devices, approximately 25 hours a week were required to irrigate

crops and water livestock, at an estimated cost of \$175 at \$7 an hour. At present, the same tasks require an hour a week, at a cost of \$7 a week. This represents an annual savings of \$4,844 for a 28-week growing season.

The data compiled for water usage was less conclusive, but a comparison of gallons used in the month of April between the years 1995 and 1998 show that less water is being used. The economic benefits of reduced water consumption result from less wear on the equipment, which means less money spent on repairs, replacement parts, and operating costs. Depending upon the scale of the operation, these methods may or may not be economically advantageous.

Reported June 1998



Outreach & Training for On-Farm Composting

Summary

The purpose of the project is to create an economically and environmentally sustainable market-based system for on-farm composting of commercial and farm organic materials. The major project tasks are to offer outreach, education, and technical assistance to farmers, organic waste generators and waste haulers in order to generate interest and participation in farm composting. The project will also develop the necessary connections and infrastructure for participants to succeed, and will document and disseminate information about on-farm composting to assist a growing circle of participants and agencies throughout New England and the nation.

The Center for Ecological Technology (CET) provides outreach and services and works directly with farmers, waste generators and haulers, while at the same time taking care not to interfere with competitive market forces. The project is proceeding successfully and according to schedule, with encouraging results. The infrastructure and marketplace for farm composting has grown significantly during the first two years of the project. To date, 47 farms have been assisted, including seven that are accepting off-farm materials. Over 9,500 tons of source-separated organic material have been sent to composting farms, with the current average at 100 to 200 tons a week. CET has also broadcast project results and availability using media, special events, workshops and conference presentations.

Objectives

- ◆ Increase the number of farms that are interested in composting on-farm materials, and increase the number and proficiency of farms that are composting on-farm materials in western Massachusetts.
- ◆ Increase the number of farms that are interested in composting commercial organic materials, and increase the number and proficiency of farms that are registered with the Massachusetts Department of Food and Agriculture to accept source-separated organic wastes in western Massachusetts.
- ◆ Increase the availability of materials for composting farms in western Massachusetts.
- ◆ Document and disseminate composting information to farmers and to agencies that are working with farmers, and facilitate networking among agencies that are working with farm composters throughout the New England region.

Key Findings

The project has helped farms recognize the importance of managing agricultural wastes economically and in an environmentally sound way, and has helped implement and improve composting programs. Most of the outreach occurred during the first year of the project; during this second year, technical support has been the primary focus. CET conducted site visits

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Collaborators

Farm Bureau
Massachusetts Department of Food and Agriculture
Massachusetts Department of Environmental Protection
Natural Resource Conservation Service
New England Small Farm Institute
Northampton Conservation District
University of Massachusetts Cooperative Extension

SARE Grant

\$60,091

Match

\$157,000

Duration

1997 to 1999

Project Number

LNE96-76



Project Number

INE96-76

with a technical composting consultant to provide operational recommendations to farmers, and distributed educational information, including the *On-Farm Composting Handbook* and videotapes, to interested farmers.

CET has demonstrated that the logistical and economic barriers of collecting and transporting off-farm materials to composting farms can be overcome successfully. CET has also recognized a growing need for technical support for farmers accepting commercial organic materials. Higher levels of management have been required as deliveries of commercial organics have increased in both frequency and volume. Problems can develop quickly if any variable or resource—time, equipment, bulk material, or weather—limits the prompt processing of incoming materials. One participating farm experienced a voluntary temporary shut-down due to these types of problems but was able to reopen several months later.

In addition, the potential for nuisance conditions (odors, vectors, litter, etc.) increases with the amount and frequency of deliveries. Several participating farms have come under increased pressure due to public and regulatory perception problems. One farm that accepts leaves from a nearby city was shut down for a week by the local zoning board until misperceptions about the operation could be cleared up.

The need to employ best management practices and to improve site conditions are increasingly important to prevent capacity reductions or actual shutdowns. Because reduced hauling rates have been based on having access to nearby farms on a consistent basis, haulers are particularly sensitive to these issues. Waste generators have also required assurances that farms receiving their materials are well managed, because of real or perceived risks to them if there are any problems.

As volumes have increased, farms have expressed an interest in access to specialized composting equipment such as windrow turners, grinders, screeners, and baggers. Most of the participating farms reach a comfort level at about 40 to 60 tons per month using existing equipment; expansion beyond this point means that other types of equipment are needed to manage at optimum levels.

Accomplishments

Each of the project staff earned a certificate of technical ability in composting at the University of Maine's Composting School. Copies of NRAES *On-Farm Composting Handbook* have been distributed to all participating farms. The frequency of farm site visits has increased, and written recommendations have been sent to each farm as a follow-up measure. Technical assistance covers any issue related to the operation including recipe development, site assessment, equipment, operations, contracting, tracking, billing, testing, and marketing the end product. Representatives from the Department of Food and Agriculture and the Department of Environmental Protection have become more informed and involved with the project. In addition to addressing compost quality issues, the project now offers free compost testing services to participating farms. Finally, CET assisted farms in relations with local and state regulators and neighbors.

CET has begun an exploration of how cooperative composting equipment services could be offered at a reasonable cost to area farms and municipalities. CET applied for funding through the Recycling Industry Reimbursement Credit program and the Agroenvironmental Technology Grants. This funding would partially defray the cost of equipment rental to allow farmers to determine which equipment is most suitable. The project would also support an economic analysis to determine the most affordable way for farmers to have ongoing access to the equipment.

As area participation continues to increase, haulers are beginning to initiate organics diversion on their own. This represents a significant change in practices from the beginning of the project, when haulers would usually only respond to requests from their customers generated by CET outreach. One of the main driving forces has been the ability to create, capture, and document economic incentives for organic waste generators. A supermarket chain with eight participating locations achieved a 23% reduction in trash generation. Project participants have reported 12% to 30% reductions in overall waste disposal costs.

Dissemination of Findings

The project has been prominently featured in local, state, and national media, including periodicals such as *BioCycle* magazine, broadcast television, and public radio. In November 1997, CET hosted a media event at C&S Wholesale Grocers Inc. to highlight the successes of the project during its first year. This event, as well as the tours that followed, drew more than 50 attendees, as well as capturing media interest.

In cooperation with UMass Cooperative Extension, CET hosted a "Twilight Meeting" for farmers about farm composting. Over 50 growers and farm service agency personnel attended the event. CET also offered slide presentations about the project at the 1997 and 1998 Northeast Resource Recovery Association Conference, the 1997

Northeast Region BioCycle Conference, the 1998 National BioCycle Conference, the 1998 New England Environmental Expo, and the 1998 National Recycling Coalition Conference.

A highlight during this period was having a professional film crew shoot a video about the project for Royal Ahold of the Netherlands, the parent company of Stop and Shop Supermarkets. Royal Ahold will use the footage for training purposes and public relations as they expand the compost diversion program internationally. CET is also working with the UMass Cooperative Extension to prepare a guide for compost use in the green industries. The guide is expected to be complete in February of 1999 and will be included in the final report.

Reported December 1998

Project Number

LNE96-76



Resource Kit for Preserving Rural Character

Coordinator

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Collaborators

New Hampshire Coalition for
Sustaining Agriculture
New Hampshire Department of
Agriculture, Food, and Markets
New Hampshire Division of Historical
Resources
New Hampshire Office of State
Planning
Rockingham Regional Planning
Commission
University of New Hampshire
Cooperative Extension

SARE Grant

\$6,000

Match

\$9,795

Duration

1998 to 1999

Project number

LNE98-109



Summary

Participants will develop educational materials to help a broad range of local officials—from planning and zoning boards to conservation commissions, state officials, and Cooperative Extension staff—to better understand what communities can do to support and sustain agriculture.

Objectives

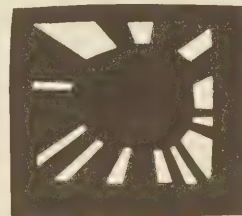
- ◆ To present a rationale for supporting agriculture.
- ◆ To provide case studies of planning actions adversely affecting agriculture.
- ◆ To provide videotaped case studies of actions supporting agriculture.
- ◆ To redefine agriculture to include new growth in nontraditional products.
- ◆ To supply existing planning strategies for sustaining agriculture.
- ◆ To present a new model for land-use regulation to sustain agriculture.
- ◆ To provide references to additional sources both in print and on the Internet.

Abstract

The purpose of this project is to equip our audience to answer the simple question, "What can we do to help ensure that agriculture will survive in our community?" Our audience is the citizen planners who sit on planning or zoning boards in New Hampshire. Since there is no formal training process for planners in rural communities, our goal is to provide a menu of creative regulatory tools to help communities shape their own land-use policies.

We propose to develop educational materials that will heighten planners' awareness of the unintended negative consequences of land-use regulations and decisions and offer specific suggestions for enhancing and supporting agriculture. The materials will be collected in a loose-leaf notebook and will be distributed to the current chairs of all New Hampshire planning boards, zoning boards, and conservation commissions, as well as to appropriate agency and extension personnel, town libraries, and the state library. A project description and ordering information will be posted on appropriate web sites.

Approved for funding March 1998



Strengthening Community Supported Agriculture in the Northeast—Next Steps

Summary

This project will strengthen a regional network of Community Supported Agriculture (CSA) stakeholders. Its goal is to expand CSA and sustain farming in the Northeast. Participants will provide technical assistance, facilitate information exchange, organize a second regional conference on CSA, and help Cooperative Extension personnel meet identified needs of new and established CSA farmers.

Objectives

- ◆ Maintain and develop the regional network of CSA stakeholders and link CSA advocates to other regional and national efforts.
- ◆ Provide services to the CSA network, including technical assistance, resource and referral, newsletter linkages, and a second regional conference.
- ◆ Strengthen and expand the roles of extension professionals in meeting the needs of existing and new CSA farmers.
- ◆ Set a research agenda specific to the needs of CSA in the Northeast.
- ◆ Set and implement a policy reform agenda specific to CSA in the Northeast.

Abstract

CSA, where producers and consumers join forces to create a fresh food supply without waste or pollution, provides the region with a compelling model for agricultural production and distribution. The 1997 CSA conference demonstrated the vitality and potential of CSA. The mission of this project is to strengthen the network of CSA stakeholders in order to promote and expand CSA as a way of securing a future for sustainable farming in the Northeast.

Building on the legacy of Robyn Van En and CSA/North America, the project will maintain and develop a regional network and provide services such as technical assistance, information exchange, and a second regional conference.

As a model of a sustainable community food system, CSA provides a viable economic alternative to the industrial food system. As such, consumers directly support the production of local, quality products using sustainable production methods. In this way, CSA has a direct, positive effect on our natural resources, on the vitality of the agricultural production system, and on the quality of life for both producers and consumers.

This project will use multiple educational approaches to strengthen CSA and inform service providers, potential CSA growers, and the general public about the benefits of CSA. At the end of the two-year project, the network and its activities will be sustainable.

Approved for funding March 1998

Coordinator

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Collaborators

Biodynamic Association
Cornell University
Equity Trust
Just Food
NESAWG
University of Massachusetts
Wilson College

SARE Grant

\$57,733

Match

\$28,800

Duration

1998 to 2000

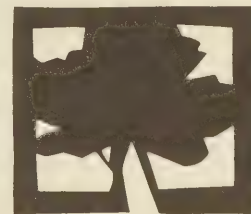
Project number

LNE98-112

**MA
NY**



forestry



Integrating Stewardship Forestry into Total Farm Management

Summary

Well-managed forests produce many environmental and economic benefits such as improved air and water quality, wood products, recreational opportunities, and wildlife habitat. Farmers are one of the largest groups of forest landowners in the United States. For this and future generations, it is essential that farmers wisely use and manage their forests.

This project established seven demonstration and research replicates to examine the economic and environmental benefits of proper farm woodlot management, and to demonstrate various management practices. Each twelve-acre replicate consisted of six two-acre treatments: a control and five timber harvesting practices. Three of the seven replicates were on state forest land, and the remaining four were on private, state parks, state game lands, and university properties. Remeasurements to gauge growth response to various treatment are complete, and should show changing stand structure and species composition shifts.

The installations demonstrate the benefits and consequences of timber harvesting to farm woodlot owners and others. The completed demonstrations have been used as part of extension workshops for landowners, foresters, and timber harvesters. The plots prove that this type of outdoor classroom is very useful for conveying forest stewardship concepts. The plots provide important baseline data for long-term monitoring of forest growth and value and changes in species composition with resulting changes in wildlife habitat and biodiversity.

Objectives

- ◆ Establish six timber harvesting demonstration and study replicates distributed in different timber types in Pennsylvania.
- ◆ Enhance the adoption of a forest stewardship ethic by farmers, timber harvesters, other landowners, and extension agents by demonstrating the impacts of various silvicultural options.
- ◆ Develop baseline data for monitoring forest growth and changes in species diversity.
- ◆ Determine the economics of sustainable forestry practices and potential contributions to the whole farm budget.

Specific Project Results

Ultimately, we established seven demonstration and research replicates. These included the six proposed in this project and another developed as part of the farmer grant program on the Freeman Tree Farm. Two additional demonstrations are now available on state forest lands and a another one on state park lands is marked and ready for harvest. The Bureau of Forestry plans to establish at least one demonstration following the model established for this project in each of the state's 67 counties.

Coordinator

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Collaborators

Auburn University
Freeman's Tree Farm
Pennsylvania Bureau of Forestry
Pennsylvania Bureau of State Parks
Pennsylvania State University
US Forest Service

SARE Grant

\$48,408

Match

\$52,948

Duration

1994 to 1997

Project Number

LINE93-37

PA

The demonstration sites have served as focal points for many tours in the past four years. Survey results indicate that these sites are effective educational tools for introducing participants to basic forest ecology and management principles. In addition, the comparison of various treatments suggests that sustainable forestry can meet a variety of landowner objectives, including economic feasibility.

Field crews collected preharvest and postharvest data at all seven sites in 1993 and 1994. Data collected included overstory tree species, diameters, and merchantable heights. In addition, they measured and described regeneration and herbaceous plant communities and established photo points to document stand development. Overstory remeasurements were completed in December of 1997; however, comparison of this data with the initial inventory is incomplete. In a cooperative effort with the U S Forest Service, the Habitat Assessment Model developed under another SARE project was run in 1996 on each site and compared across treatments to demonstrate how harvesting affects wildlife use.

Initial data served to develop the total economic value before harvesting and the value realized from harvesting the blocks. Simulations of value change over time, although planned, remain undone. A new graduate student, entering the program this winter, may complete this phase of the project.

Dissemination of Findings

All of the sites continue to host tours, although use varies by location. The replicates on the Freeman Farm, Stone Valley Experimental Forest, French Creek State Park, and State Game Lands 211 are the most frequently used. This most certainly relates to their location and the commitment to the maintenance and use of the sites to influence forest management. The other three sites are more isolated. Nonetheless, all seven sites contribute to the objective to reach specific audiences.

Handouts and brochures convey the nature of materials developed to reach target audiences using the sites. The replicate was a featured element in a celebration of the 50th anniversary of the tree farm program; on that one day alone, more than 300 landowners and interested citizens visited the site. As an aside, The Freeman Farm received the 1998 National Tree Farm of the Year Award from the American Forest Foundation. This the first time that

the national winner has come from Pennsylvania, and we are confident that the structure plots played an important role in receiving this recognition. The Stone Valley site has hosted 60 students participating the Pennsylvania Governor's School for each of the past three years. That same site also played a prominent role in a day-long program for 50 teachers participating in the Pennsylvania Alliance of Environmental Educators workshop this fall.

State Game Lands 211, only ten miles north of Harrisburg, receives high numbers of visitors. For the past three falls, volunteers with the state's Forest Stewardship Program have hosted tours through the state game land. Normally the road just beyond the replicate is closed, but on one Saturday each fall the commission opens the road for people to enjoy the area's scenic beauty. The local extension agent works with the volunteers to maintain the trail through the site and the signs along the route. This summer, the Pennsylvania Game Commission chose to develop a 13-part public television series on the state's forest and wildlife resources. This replicate played a prominent role in one of these segments addressing the role of white-tailed deer and forest renewal.

The French Creek State Park replicate is nicely sited for use by schools in and near Philadelphia. In 1997, a graduate student at Pennsylvania State working with the Bertram Cluster in Philadelphia used this site to evaluate the role of demonstrations in helping urban youth understand forest management.

The Sustainable Forestry Initiative of Pennsylvania, part of an American Forest and Paper Association effort to ensure sustainable forestry practices, is using the replicates in various ways. All of the loggers participating in the first-level Sustainable Forestry Course visit through slides one of the sites. During the presentation they have the opportunity to compare various cutting practices, including high-grading. To date, more than 800 Pennsylvania timber harvesters have completed this course. During the second-level course the timber harvesters will visit one of the sites and collect data on forest regeneration. Interestingly, two of the sites are now part of another demonstration project showing the impact of water quality best management practices funded by a grant from the Pennsylvania Department of Environmental Protection.

Potential Contributions and Practical Applications

Farm woodlots are typically a source of quick cash, and are too frequently harvested without regard for future income and productivity. Woodlots managed with this approach cannot sustainably produce high-quality products. What many farmers and other landowners do not realize is those woodlots are an asset—an asset that, if managed in a more sustainable fashion, can produce reliable periodic returns. In Pennsylvania, “high grading,” or taking the best and leaving the rest, is a widely employed harvesting practice on private forest lands. It provides immediate large financial returns, but it ruins the resource for future years and perhaps future generations. The treatment that demonstrates “high grading” has proven useful in conveying the consequences of such a practice. An improvement thinning, again one of the practices demonstrated, demonstrates an investment in the future forest by increasing residual tree vigor and productivity while at the same time providing some immediate financial return. Workshop participants see the differences between sustainable and unsustainable forestry firsthand.

Perhaps one of the unanticipated and yet very valuable benefits of this project has been the variety of audiences who use the sites and the number of messages that the sites convey to the users. The Bertram Cluster project with an inner-city Philadelphia school showed that providing examples of various harvesting practices in close proximity helps students understand the environmental effects of timber harvesting. Working with diverse audiences, we learned that demonstration projects can change knowledge and attitudes within groups. Most specifically we have shown that participants in education programs more readily understand and accept clear cutting as a management tool after viewing the demonstration areas.

After viewing the sites, timber harvesters often express changes in their understanding of timber

harvesting impacts. More specifically, they recognize the potential to cause adverse shifts in species composition, stand structure, and rotation length through the application of diameter-limit harvests. This revelation has particular application as the Sustainable Forestry Initiative of the American Forest and Paper Association continues to expand across the country.

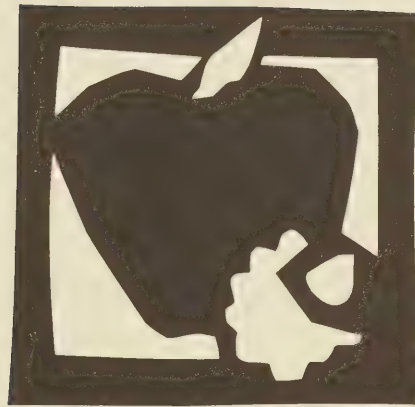
New Hypotheses

Evaluation results from workshops indicate that participants acquire useful information. Outdoor demonstrations enhance learning in the areas of forest ecology and management. Future research might include determining how long knowledge stays with a person and how often reinforcement is necessary. In addition, what effect does this knowledge have on future woodlot management practices? Will fewer landowners “high-grade” because of what they have learned? Does the impact of the harvest demonstrations change as the immediate visual impact of harvest declines? Can timber harvesters and professional foresters use the sites to change client notions about the merits of harvesting large, old trees to benefit small, young trees? Will the demonstrations serve to show the combined effects of timber harvesting, tree and plant regeneration, and white-tailed deer feeding?

Farmer Adoption and Direct Impact

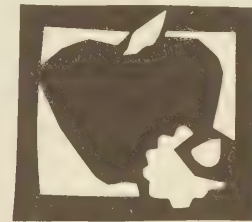
Research to determine whether visiting the demonstration areas causes farmers or other landowners to change their management practices was not a formal part of this project. However, it is safe to say that many landowners seemed enlightened about the consequences of “high-grading” versus more sustainable methods of timber harvesting. Research did show that the sites were effective in changing attitudes toward clearcutting as a viable management tool. There is also evidence that the replicates are useful in convincing visitors of the negative changes that high white-tailed deer populations cause in forest systems.

Reported December 1998



fruits

Improving the Profitability & Adaptation of the High-Density Strawberry Production System for the Northeast



Summary

Farmers in the eastern United States have traditionally grown strawberries in matted rows, but there is considerable interest in adapting the high-density annual systems now used in Florida and North Carolina. The late-summer planting system, based on integrated crop management (ICM) techniques, includes raised beds, black plastic mulch, and trickle irrigation, with plants spaced in staggered double rows. The late plantings afford relief from the heat, drought, weed, and disease pressure of midsummer and the plastic protects against fruit diseases and eliminates herbicide use. The resulting early spring crop commands higher prices in the marketplace.

This project researched ways to increase the profitability and geographic adaptability of this plasticulture system. As a result, many commercial growers in New Jersey have already converted their acreage to this new method.

Objectives

- ◆ Optimize an integrated strawberry production system involving genetic, cultural, and environmental aspects with improved profitability and decreased pesticide dependence.
- ◆ Investigate the influence of location, planting date, plant type, and floating row covers (FRC) on earliness, productivity, quality, and profitability.
- ◆ Compare selections (NJUS and MDUS strawberry breeding programs) and eastern-adapted cultivars to 'Chandler' for pest resistance, earliness, productivity, and quality.
- ◆ Study the efficacy of poultry manure and chicken parts compost as the primary nutrient source, or as a replacement for fumigation.
- ◆ Study double cropping strategies with vegetables and renovation practices for maintaining the strawberry planting for a second production year.
- ◆ Extend research and development information on the system to encourage rapid commercial adoption.

Key Findings

Plasticulture profitability is 300% higher than matted rows. This method makes strawberries one of the most profitable crops on a per-acre basis.

Vegetable double cropping after strawberry harvest brought additional profits.

Eastern-adapted cultivars and advanced breeding selections were high-yielding, large-fruited, and offered season extension over the variety standard, 'Chandler.'

The clones showed excellent pest resistance, eliminating the need for all fungicides except Botrytis.

Organic nitrogen (N) nutrition was comparable or superior to conventional inorganic N. All organic N can be incorporated before planting, eliminating costs associated with mid-season fertilizing.

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Collaborators

Area farmers
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Wye Research and Education Center

SARE Grant

\$96,204

Match

\$125,747

Duration

1995 to 1998

Project number

LNE95-57



Methods and Results

As the agricultural value of land in the Northeast continues to loose the battle against the real estate development value of the land, the agribusiness industry is turning to high-efficiency production systems that allow maximum profitability from the land. Plasticulture allows strawberries to be cropped as an annual. Second-year cropping and vegetable double cropping offer options to further increase profitability. This system has shown consistently high commercial profitability in southern New Jersey.

Though establishment costs are higher, the value of the early, high-quality crop is greater. Labor costs are reduced—there is no setting of daughter plants or hand weeding, and the fruit is more easily and efficiently harvested from the beds.

The analysis showed that if a commercial grower harvests 15,000 lbs per acre, sells the fruit for \$2 per lb, with \$13,362 in expenses (including harvest), the net is about \$16,638 per acre. An average matted-row scenario of 10,000 lbs per acre at \$1.33 with \$7,811 in expenses equals \$5,489 per acre net. The value of the fruit has been even higher in the “borderline” locations, and that has helped to rapidly spread the system to those areas. There are also organic growers in New Jersey and Maryland using the plasticulture system and marketing the fruit for double the commercial price.

The growth of the system in the region has simultaneously induced the beginnings a new nursery industry for tips and plugs specifically for the plasticulture system.

The plasticulture system is based on ICM practices that avoid and reduce disease and insect pressure. The system decreases the dependency on chemical pesticides by maintaining a microclimate that is not conducive to pest development, and by physically excluding pests from the susceptible plant material.

Black plastic mulch eliminates the need for herbicides and fumigation against weeds, since it blocks the light needed for weed seed germination and development. It also prevents the fruit from contacting the soil and reduces soil splashing onto the fruit, decreasing Botrytis fruit rot and leather rot. The raised bed allows greater air movement through the vegetative canopy, allowing for quicker drying of the dew and rainfall, thereby avoiding disease-promoting conditions on leaves and fruit. The

beds also allow the soil to drain more efficiently, reducing or eliminating root diseases such as red stele and black root rot.

Plants are only in the field for a short time with this system, thereby avoiding many pest problems. Older plantings are more likely to encounter viral infections as they age because they have more chances to be exposed to vectors such as aphids and nematodes. Root weevils are eliminated as a pest since plants are removed immediately following harvest, thus removing their food source from the field. The annual system greatly reduces sap beetle problems, which are more prevalent in held-over matted-row beds. Plant trash is greatly reduced as leaves are much younger, greatly decreasing the inoculum source for Botrytis. Leaf spot cover sprays in the fall are eliminated as the growth is much younger and has not been exposed to inoculum during the heat of the summer.

Floating row covers (FRCs) are an integral part of plasticulture, increasing flower bud initiation in the fall, providing winter and frost and freeze protection, and promoting earlier fruiting. For ICM, FRCs also serve in avoiding insect infestations by physically excluding pests such as tarnished plant bug. Since the FRCs promote an earlier crop, they also serve to accelerate plant development past the susceptible stage before the pest emerges, as with the strawberry clipper. The degree of effectiveness is dependent on over-wintering habits of particular insect species, as well as environmental conditions, especially in the growing season previous to the harvest season.

At the core of ICM principle is the use of an innate genetic resistance to pests as the most efficient means of control. The NJAES and other eastern breeding programs have selections with excellent fruit flavor and size for fresh market production in the system. The genetic disease resistance and general adaptation of these varieties allows them to be grown with fewer fungicides. The selections have resistance to Red Stele and Verticillium wilt; therefore, fungicide sprays for these diseases have been eliminated.

Currently the best option for the Northeast is the use of transplant plugs that are propagated from actively growing runner tips. The plugs, planted in late August and early September, were the standard for the system and offered the most consistent results; however, variety choices were limited.

These plugs are costly, at about \$130 per 1000. A by-product of fresh-dug plants are the multiple-crowned mother plants. Two years of investigation revealed that the fresh multiple-crown mother plants were high yielding and superior to conventional plugs when planted after the recommended planting dates. This plant type can provide a significant buffer for late planting opportunities in northern locations. FRCs applied in mid-October also compensated for late plug planting.

A critical issue facing strawberry growers involves the dependence of current strawberry production on agricultural chemicals for pest control. Eastern cultivars and advanced breeding selections were high-yielding, large-fruited, pest resistant, and offered season extension over the variety standard, 'Chandler.' Advanced selections from the NJUS and MDUS breeding programs also performed well. Disease resistance of the selections was excellent, eliminating the need for all fungicides except bloom sprays for Botrytis. Based on a combination of superior yield and fruit weight, the varieties 'Allstar,' 'Noreaster,' 'Seneca,' 'Earliglow,' and 'Latestar' are now being commercially planted in the system. The demand for these varieties has fostered the development of a new nursery industry in the region.

Another issue facing strawberry growers involves the contamination of groundwater supplies from the overuse of synthetic N fertilizers. Research showed the yield of organic N nutrition treatments was comparable or superior to conventional inorganic N plots. There were no differences in yield, primary, or average fruit weights with regard to N application timing. Results show that with organic N in a plasticulture system, all N can be preplant incorporated, eliminating the need for the increased cost and equipment necessary for spring fertilization.

Two alternative components are available for maximizing the profitability of this system: carryover beds for second year strawberry fruiting, and double-cropping with vegetables after the first or second strawberry harvest.

Our tests showed no differences in the organic versus conventional carryover beds. The eastern varieties were typically superior to 'Chandler' in second year plots due to superior disease resistance. In general, when yields of first-year beds are high, lower yields and smaller fruit are expected for the second year; when yields of first-year beds are low, high yields and good fruit size are obtained in the

carryover beds. In practice, commercial growers have used carryover beds for pick-your-own and to wholesale a less expensive alternative to the fruit from the first-year beds. A significant portion of the experienced growers are now increasing profitability by maintaining the plantings for a second harvest season.

The success of vegetable double cropping from 1995 through 1998 with tomatoes, peppers, melons, pumpkins, zucchini, or spaghetti squash depended on the specific growing season during and after strawberry harvest. In the warm seasons, when strawberry harvest was early, high yields of tomatoes, peppers and pumpkins were obtained. In the cooler seasons, when strawberries were late, the short-season zucchini squash was the best choice.

The flexibility of plant types, planting dates, varieties, N nutrition, second-year strawberry harvest, and vegetable double cropping has improved the profitability of the system and allowed it to move into more northern locations. Grower adoption has increased rapidly in the region, with about 200 growers in the region currently using this system, up from about 20 in the early 1990s.

We can conservatively track the expanding commercial adoption of the system throughout the Northeast. Walker Brothers/Jersey Asparagus Farms (WBJAF) sold over a million tips and plugs to 109 commercial growers in 1997, and over 1.1 million tips and plugs to 138 commercial growers in 1998. Davon Crest Farms (DCF) sold about 575,000 plugs to 30 growers in 1997 and 575,000 again to 35 commercial growers in 1998. That is over 170 growers in 1998 from these two nurseries alone, and that does not include the significant number of growers who are using dormants. Both WBJAF and DCF noted that in 1998 many of the experienced growers were keeping the planting for a second year and that there were also many new growers trying the system for the first time. Scott Walker from WBJAF estimates he could have sold 50,000 to 75,000 more if he had the material. Many growers called very late trying to purchase plugs. He projects a potential 20% increase in plug sales annually, and that the demand for eastern varieties will increase dramatically in the future.

Site Information

The plasticulture system originated in the moderate California climate and has allowed close to

Project number

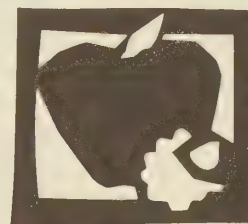
LNE95-57

year-round production in the state. From the 1980s through early 90s it has become the system of choice in the Southeast, and is practiced on over 1000 acres in North Carolina. University research has moved the system into the eastern shore of Maryland and Virginia as well as southeastern

coastal New Jersey. The system has thrived where the soils are light and the climate is moderated by large bodies of water.

Research and commercial locations were chosen to optimize profitability and to expand the adaptation of the system.

Reported November 1998



Impact of Herbicides on Beneficial Insects of Blueberry and Cranberry

Summary

We are investigating the effects of herbicides on the diversity and abundance of forage plants and beneficial Hymenoptera (bees and wasps) in blueberry fields in Maine and cranberry bogs in Massachusetts.

Objectives

- ◆ Determine the effects of herbicide use on flowering weeds (diversity and abundance) and Hymenoptera (diversity and abundance).
- ◆ Determine the extent that field border characteristics reduce the effects of herbicides on the diversity and abundance of Hymenoptera.
- ◆ Determine how the abundance and diversity of beneficial Hymenoptera influences crop productivity (fruit set, berry weight, and seeds per berry).

Background

The goal of this research is, ultimately, more sustainable production of lowbush blueberry and cranberry through more reliance on beneficial insects and less reliance on pesticides in these important and extensive agroecosystems in the Northeast. This in turn will contribute to a cleaner environment and safer, healthier food. Broadleaf herbicides kill plants that bees and wasps use for forage. Other herbicides control grasses, rushes, and sedges, which while not forage plants, may provide important microhabitats for beneficial bees and wasps.

Sixteen lowbush blueberry fields and ten cranberry bogs were sampled in 1998 for diversity and abundance of noncrop plants and Hymenoptera. In lowbush blueberry, 42 weed species were found; the number of flowering plant species present ranged from three to thirteen per study site, including species in the adjacent forest. The most prevalent species were bunchberry, sheep laurel, raspberry, and bush honeysuckle. For cranberry, the number of species present ranged from 11 to 46 per study site. The most prevalent weed species for cranberry were dodder, yellow loosertrife, dewberry, and cat's ear.

Over 2,400 samples have been sorted into major categories of beneficial Hymenoptera, a subset of which have been sent to specialists out for identification so that the presence and abundance of individual species can be correlated with weed cover and yield findings. A preliminary analysis investigating beneficial Hymenoptera abundance in blueberry for 1997 indicates that field size and percentage weed cover were related to the number of parasitoids that were recovered. In general, large fields had 41% more wasps than small fields, and the weedier fields had 27% more wasps than the less weedy fields.

An important new finding in 1998 is the presence of an excellent pollinator of cranberry, previously only known in New Jersey bogs—we have found the leafcutting bee *Megachile ad-denda* in Massachusetts cranberry bogs. In fact, it was the most abundant bee captured and was present in all bogs sampled in 1998, which suggests it has good potential as a supplemental pollinator in Massachusetts cranberry bogs.

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Collaborators

University of Maine

SARE Grant

\$150,000

Match

\$148,627

Duration

1996 to 1998

Project Number

LNE96-64

ME

Specific Results

Hymenopteran abundance and diversity was again estimated in all fields and bogs using three sampling techniques: baited traps, flight interception traps, and malaise traps. In addition, nine 30- to 45- foot. towers of two-inch rigid conduit were erected at six sites and extended above the canopy of the forest. Each tower had intercept traps at various levels. Hymenoptera were collected throughout bloom on a weekly basis and then biweekly for six collection dates for each crop. Also, in four blueberry and three cranberry fields, sweep-net samples were taken as well as one-minute visual counts of bees in each of 15 one-square meter vegetation plots during bloom. Additionally, 200 wooden nesting blocks for leaf cutting and mason bees (Megachilidae) were set up in the cranberry bogs; the bees will be reared out this February. In 1998 for cranberry, 11 nonparasitic bee genera were collected: *Agopostemon*, *Andrena*, *Augochorella*, *Bombus*, *Ceratina*, *Colletes*, *Dialictus*, *Evylaeus*, *Lasioglossum*, *Megachile*, and *Osmia*.

Cluster analysis was used to group cranberry bogs sampled in 1998 by floral and plant density per taxa. There were no groupings of floral or plant density that closely matched the cluster tree produced from an analysis of the number of bees by genus. At this time, it does not appear that the differences in bee communities and floral density between bogs are directly related. However, it should be noted that many of the bogs adjoined residential areas with ample floral resources. The analysis also revealed that clear regional differences existed between bee communities.

Among the categories of beneficial Hymenoptera, Dr. J. Cane has confirmed our identification of the leaf cutting bee *Megachile addenda*, which is an important new record for Massachusetts cranberry bogs. Cane found it to be an effective pollinator of cranberry in New Jersey bogs. In 1998, this species was the most frequently captured bee and was present in all bogs sampled, which suggests it has good potential as a supplemental pollinator in Massachusetts cranberry bogs.

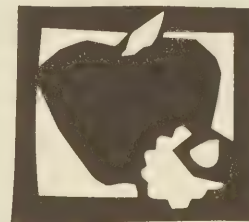
There was no apparent relationship between the number of bees recovered in 1997 from blueberry fields and the variables of field size or weediness. By contrast, both field size and percentage weed cover were related to the number of parasitoids that were recovered. In general, large fields had 41% more wasps than small fields and the weedier fields had 27% more wasps than the less weedy fields.

A measure of herbicide-intensity for 1998 is being derived from our periodic visits to the study sites, grower spray records, and interviews with growers. It would be premature to draw major conclusions until the data are analyzed for the 1998 samplings.

To more fully understand the interactions that occur between the Hymenoptera of the blueberry field or cranberry bog and the adjacent forests, we extended our sampling transects into the adjacent forests at study sites. Once the samples are analyzed, we will be able to determine whether smaller fields with more forest edge reduce the effects of herbicides on beneficial bees and wasps.

To accurately assess how the abundance and diversity of beneficial Hymenoptera influenced crop productivity, the results from the Hymenoptera specialists need to be yet obtained. We are in the process of obtaining yield information for blueberry; it has been obtained for cranberry.

Reported December 1998



Sustaining Grape Production in the Northeast through Farm-Tested Information Technologies

Summary

Management of pests on grapes in the northeastern United States has historically been dependent on routine pesticide applications. Growers are unable to use weather information and pest predictive models to time applications more precisely and in a way that would reduce pesticide use.

This project uses the knowledge of grape growers in Pennsylvania and New York to direct the development of weather acquisition tools and computer-based support tools such as VITIS and SkyBit that would help them in making decisions on sustainable practices.

Objectives

- ◆ Use participatory grower organizations in the grape industry to develop and farm test new information tools.
- ◆ Evaluate the usefulness, reliability, cost, and acceptance of weather information sources for grower use in sustainable vineyard management decision making.
- ◆ Incorporate sustainable vineyard management tools such as predictive pest models and site-specific weather information and forecasts into SkyBit and the VITIS expert system, and evaluate their impact on decision making in commercial vineyards.

Findings to Date

Grape growers find TV, radio, and SkyBit reports to be useful tools in disease management. Growers provided valuable information on the accuracy and reliability of the SkyBit weather summaries.

Growers are working with pathologists to determine the best ways to use predictive disease models in grape disease management.

Method

Northeastern grape growers are unable to reduce pesticide use because site-specific weather information is difficult for growers to collect and use in decision making. Also, pest scouting is time consuming and interpretation of the information is difficult, and pest models have not been delivered to growers in a format they can use in decision making.

This project combines several sustainable vineyard management tools such as site-specific weather information and predictive pest models into the VITIS expert system. VITIS is being developed as a management tool to assist growers in interpreting complex weather and cultural information, and to help grape growers make informed decisions.

Surveys showed grape growers use their computers primarily for business and e-mail. However, growers expressed an interest in computer-based decision aids.

Growers and subject-matter specialists in plant pathology from Pennsylvania and New York have convened to determine which predictive pest models to incorporate into VITIS. The models use vineyard and pest history, along with site-specific weather information, to forecast current disease levels and to predict disease levels one and two days into the future.

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Cornell University
New York and Pennsylvania grape
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National Grape Co-Operative
Pennsylvania State University

SARE Grant

\$147,943

Match

\$74,872

Duration

1997 to 1998

Project number

LNE96-72

NY
PA

Project number

LNE96-72

This project has been structured to attain maximum grower participation. Group discussions have been designed to value both farmers' and scientists' knowledge and experience and to promote meaningful dialogue.

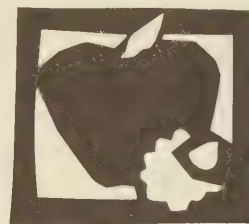
Field evaluation of VITIS and the SkyBit weather data acquisition systems is proceeding. In the winter of 1997, twelve growers in the region were selected to receive intensive instruction on the Windows VITIS expert system. In April, another training session will be conducted to review the use of the VITIS expert system as a management tool. The growers' use of the VITIS expert system during the 1999 growing season will be recorded and used to further refine the expert system.

SkyBit is a commercial product designed to give detailed weather information specific to a particular vineyard that can be received by the grower as often as daily and as infrequently as weekly, depending on

the grower's needs. Taking into account the vineyard's latitude and longitude, SkyBit's satellite and weather reports are then used to calculate variables ranging from temperature to wind speed and direction to soil temperature throughout the course of the day, as well as forecast up to ten days ahead. Growers received daily SkyBit reports via e-mail throughout the 1998 growing season.

Growers evaluated pest models using remotely sensed SkyBit weather data for the first time in 1998, and they found the information very helpful. The models were originally developed in growth chambers and greenhouses but have not been thoroughly evaluated under vineyard conditions. Growers are observing disease incidence and comparing the results to disease forecasts. Their input has been valuable in modifying the models to improve their accuracy.

Reported December 1998



A Strawberry IPM Systems Comparison Demonstration

Summary

This project compares three different strawberry pest management systems—transitional to organic, future IPM, and conventional IPM for managing pests in upstate New York. This long-term project began in 1995 with cover crop plantings of marigolds and rye grass. In 1996, four cultivars of strawberries were planted: 'Honeoye,' 'Earliglow,' and the day-neutral cultivars 'Tribute' and 'Tristar.' Two planting systems—a matted-row and ribbon-row system—were used to compare pest and yield differences. Weed, insect (primarily tarnished plant bug), slug, and disease (*Botrytis*) evaluations were conducted throughout the growing season and yield and assessments were made at harvest.

Objective

- ◆ To develop, compare, and demonstrate three different strawberry IPM systems—transitional to organic, future IPM, and conventional IPM—for managing the primary pest complex of strawberries grown in the northeastern United States.

Key Findings

Yield assessments showed that the ribbon row planting system (future IPM and transitional to organic) continued to have lower yields compared to the matted-row planting system.

Control of most weeds was generally good in all treatments except for dandelions, where pressure was twice as great in the transitional-to-organic treatment as it was in the future IPM and conventional IPM treatments.

The results of the alternative control tactics studied during 1998 were mixed. *Botrytis* pressure was greater in 1998 than 1997; however, honey bee delivery of the biocontrol agent *Trichoderma harzianum* provided commercially acceptable levels of disease control.

Using beer-baited cups to trap slugs did not reduce slug density or the number of slug-damaged berries in treated plots compared to untreated plots.

Tarnished plant bug populations were much lower in 1998 than in previous years, and three releases of the wasp parasitoid, *Anaphes iole* (45,000 per acre), did not significantly reduce tarnished plant bug damage compared to other treatments. Spraying alfalfa borders with two applications of malathion or treating the entire plot with two applications of malathion did reduce tarnished plant bug damage to low levels. The cultivar 'Honeoye' had the fewest tarnished plant bug nymphs, indicating resistance to this pest.

Economic Analysis

Economic analysis showed that the conventional IPM treatment was the least expensive and produced the greatest number of marketable strawberries. In order for the transitional-to-organic treatment to be as profitable as the conventional treatment, a price differential of at least twenty-five cents more per quart of strawberries would have to be charged. Data will continue to be collected from these plots over the next several years.

Reported December 1998

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Collaborators

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SARE Grant

\$116,586

Match

\$31,596

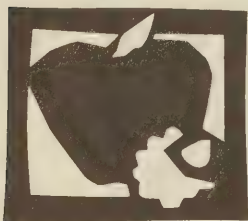
Duration

1997 to 2000

Project Number

LNE97-80





Potential of Earthworms as Biocontrol Agents of Scab & Leaf Miners in New England Apple Orchards

Coordinator

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Collaborators

University of Connecticut
University of Maine
University of Massachusetts
University of New Hampshire
University of Rhode Island
University of Vermont
New England apple growers

Duration

1997 to 2000

SARE Grant

\$99,790

Match

\$37,796

Project Number

LNE97-81

**NH, CT,
ME, MA,
RI, VT**

Summary

This project is exploring the use of earthworms in apple orchard pest management and soil health through an integrated approach of using the earthworm as a natural biocontrol agent.

Objectives

- ◆ Quantify leaf litter removal by earthworms as a measure of the potential of earthworms to reduce primary inoculum of *Venturia inaequalis*, the causal agent of scab, and overwintering populations of the apple blotch leaf miner and spotted tentiform leaf miner in New England apple orchards that use conventional, IPM/low-input sustainable, or certified organic pest and crop management practices, or have been abandoned.
- ◆ Develop case histories of orchard management in selected apple orchards throughout New England that have followed conventional, IPM/low-input sustainable, and certified-organic programs of pest and crop management, and compare leaf litter burial with orchard case histories to provide insight into orchard practices favorable or unfavorable to earthworms and leaf burial.
- ◆ Develop an education and outreach plan that will introduce apple growers, fruit specialists, Cooperative Extension agents, commercial apple consultants, and others in New England involved in apple production to the project objectives, and inform them of the results and potential to increase the sustainability of their orchards, regardless of the crop production system employed.

Methods and Findings

Leaf removal from plots established in sod underneath apple trees was monitored in 26 commercial orchard blocks throughout New England and in two research blocks at the University of New Hampshire's Woodman Horticultural Farm. Four plots were established in the sod drive-row in each orchard. Each plot consisted of twenty intact apple leaves of uniform size placed in a wood frame with a plastic mesh netting stretched over the frame to keep the leaves in the frame. Before the leaves were placed in the frame, all pre-existing leaf litter was removed and the grass was cut to 5 cm. The plots were established in late autumn 1997 and assessed for leaf removal and leaf skeletonizing in the spring of 1998. Missing leaves were attributed to leaf removal by earthworms; portions of leaves missing or skeletonized were attributed to slugs and other organisms. The original leaf tissue missing in spring was less than 25% in nine orchards, 26% to 50% in three orchards, 51 to 75% in eight orchards, and more than 75% in three orchards. Data were not collected from four orchards due to disturbance of the plots.

Pest management practices in each orchard were classified as organic, advanced IPM, minimal IPM, or conventional with respect to selecting and scheduling pesticides. There were great differences in the amount of missing leaf tissue among the orchards, but there was no relationship between the percentage of missing leaf tissue and the pesticide program classification. The original leaf tissue missing in spring ranged from none to 74% in organic orchards, 8% to 99% in advanced IPM orchards, 11% to 96% in minimal IPM orchards, and 2% to 69% in conventional orchards. Leaf removal attributed to earthworms ranged from no leaves removed in four orchards (one orchard in each pest management category) to 93% in one minimal IPM orchard and 98% in one advanced IPM orchard. The destruction of leaves attributed to slugs and other organisms ranged from none to 48%

in organic, 6% to 59% in advanced IPM, 8% to 50% in minimal IPM, and 2% to 34% in conventional systems.

It was hypothesized that orchards with a history of using only organic practices or following advanced IPM guidelines would have a greater loss of leaf litter than orchards that had used minimal IPM practices or followed conventional pest management practices. However, there was no relationship between leaf litter loss and orchard management practices. What was shown, though, was that the total leaf tissue missing at the beginning of the growing season was very high in two orchards (96% and 93%), high in one orchard (85%), and moderately high (74% and 73%) in two orchards. The high loss of leaf litter in these orchards has important implications for decision making with respect to pest management because the percent of leaf litter lost is related directly to the loss of potential inoculum produced by the fungus causing apple scab and of overwintered leaf miner pupae. Eliminating 85% of the leaf litter, for example, will reduce by approximately 85% the fungal spores (ascospores) that will infect the leaves and fruit for several weeks in early spring, and will also reduce by approximately 85% the initial population of adult leaf miners that will emerge and mate during half-inch green to pink.

The study is being repeated to see if the level of leaf litter removal and destruction activities in each orchard resulting from overwintering conditions during 1998/1999 is consistent with the level determined for 1997/1998.

Project Results

There was no relationship between orchard pest and crop management practices and the amount of leaf litter removed by earthworms or lost due to feeding activities of other organisms.

There was a significantly high loss of original leaf tissue (greater than 75%) in five of twenty-two orchards that were assessed for leaf litter at the beginning of the growing season.

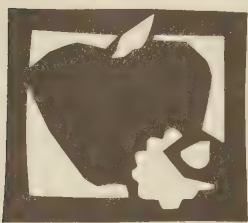
A reduction of leaf litter in excess of 75% due to removal and skeletonizing by earthworms and other organisms reduces the risk of scab comparable to that of sanitation practices such as mulching the leaf litter with a flail mower or treating the leaf litter with a nitrogen fertilizer such as urea. Thus, an orchard that has high biological activity for destroying leaf litter in which the scab pathogen overwinters also has potential for integrating natural removal of the leaf litter by biotic agents with sanitation practices for the purpose of determining an orchard's qualification for reducing fungicide dose according to a "sanitation" action threshold developed for the northeastern U.S.

A reduction of leaf litter of more than 75% due to removal and skeletonizing by earthworms and other organisms may reduce the initial adult leaf miner population emerging from the leaf litter to a level that could lower the first generation of sap-feeding mines below the threshold recommended for applying the first leaf miner insecticide treatment. It may also result in lowering the development of second-generation sap-feeding mines below the threshold for applying the second leaf miner treatment.

Reported January 1998

Project Number

LNE97-81



Integration of Behavioral, Biological & Reduced-Risk Chemical Approaches into a Sustainable Insect Management Program for Cranberries

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Collaborators

University of Massachusetts
Ocean Spray Cranberries
3M Canada Company
Pine Island Cranberry Company

SARE Grant

\$133,179

Match

\$210,000

Duration

1998 to 2001

Project Number

LNE97-85



Summary

This project is to develop a biorational integrated pest management (IPM) program to control sparganothis fruitworm and fireworm, significant cranberry pests. Strategies include mating disruption, the use of beneficial parasites, pest predators, and the use of a reduced-risk selective insecticide.

Objectives

- ◆ To develop a microencapsulated formulation of *E11*-tetradecenyl acetate for disrupting mating in the sparganothis fruitworm, *Sparganothis sulfureana* Clemens, by evaluating several rates and by monitoring the pheromone release rates of the encapsulated formulation under field conditions.
- ◆ To evaluate the potential of the egg parasitoid, *Trichogramma minutum* Riley, in managing the populations of spotted fireworm, *Choristoneura parallela* Robinson.
- ◆ To assess the effects of application method, rate, pest development stage, and pest species on toxicity of tebufenozide to major lepidopterous pests in New Jersey.
- ◆ To conduct an economic and ecological analysis to compare the cost efficiency and effectiveness between the new and traditional insect management technologies in cranberries.

Key Findings

The feasibility of disrupting the mating of sparganothis fruitworm with a sprayable microencapsulated formulation of (*E*)-11-tetradecenyl acetate (*E11*-14:Ac), the major pheromone component, was evaluated in New Jersey. Application of encapsulated *E11*-14:Ac, at 10 to 75 g active ingredient per acre reduced the incidence of mating of virgin females placed in treated plots compared to those placed in untreated plots. Larval density and fruit damage was significantly lower in plots treated with 25, 50, or 75 g active ingredient per acre of *E11*-14:Ac than in the untreated control. Air and foliage samples were collected to determine the titres of *E11*-14:Ac throughout the flight duration. *E11*-14:Ac levels in air and foliage samples declined sharply one week after the aerial application. However, detectable levels of *E11*-14:Ac were present in both air and foliage samples throughout the four-week post-treatment sampling period. Multiple applications at lower rates of pheromone (5 to 10 g active ingredient per acre) are thought to be more effective in maintaining pheromone levels.

We evaluated two rates of *Trichogramma* egg parasitoids, 0.75 and 1.5 million per acre, and a control in a replicated field trial to suppress spotted fireworm egg mass populations. Rates of parasitism of egg masses by *Trichogramma* egg parasitoids were significantly higher in the *Trichogramma* released plots at both rates evaluated than in the control plots. The percentage of egg masses parasitized was only marginally higher at the higher parasitoid release rate (1.5 millions per acre) than the lower rate (0.75 millions per acre).

A series of dose-mortality bioassays was completed against first and fourth instar larvae of sparganothis fruitworm and spotted fireworm. These studies indicated that both these species are very susceptible to tebufenozide. In both these species, first-instar larvae were more susceptible than fourth-instar larvae.

Findings and Accomplishments

During the first-generation flight, E11-14:Ac at 25 g, 50 g, and 75 g per acre and an untreated control were evaluated on four cranberry bogs that varied from 2.2 acres to 2.8 acres. Mating disruption was assessed by monitoring male moth catches in virgin female baited traps, and by determining the incidence of mating in PVC cages.

Male moth counts in pheromone traps were significantly lower in the treated bogs than in the untreated control. Trap shut-down was not significantly different among the three treated bogs; no dose-dependent response was seen in trap catches. A lower percentage of virgin females enclosed in the PVC mating cages were found mated in the treated bogs than in the untreated control bog. Mating appears to be affected for the entire four-week test period, irrespective of the pheromone rate applied. Again, the percentage of mated females was not significantly different among the three treatments. Fruit damage and larval density were significantly lower in the three treated bogs than in the untreated bog. There was slightly higher larval density and fruit damage in the 50 g treatment than in the 25 g or 75 g treatment, paralleling the slightly higher trap catches and mating observed in this treatment than in the 25 g or 75 g treatments. The damage sustained in the mating disruption plots is around 1% to 2%, which is comparable to the currently available standards. This level of protection provided by mating disruption is certainly commercially acceptable.

During the second-generation flight, 10 g, 25 g, and 75 g of active ingredient per acre were evaluated. A lower pheromone rate (10 g) was included to determine the lowest rate at which mating can be disrupted. Male moth catches in virgin female baited traps were significantly lower in the pheromone-treated bogs than in the untreated bogs. Again, there were no clear trends showing the effects of pheromone rate on trap catches. Significantly fewer virgin females that were enclosed in PVC mating cages were found mated in the treated bogs than in the untreated control bog. Mating appeared to be affected for the entire three-week test period, irrespective of the pheromone rate applied. Percent mating in both the 25 g replicates was significantly greater than either the 10 g replicates or the 75 g replicates; reasons for this anomaly are unclear.

The E11-14:Ac levels in air were relatively high (100 to 400 ng/m³) within the first week or so after the pheromone application in 1997. Detectable levels were present over the entire experimental period of about four weeks, but at much-diminished levels towards the end of the four-week period. Foliage levels of pheromone in all treatments decreased by a factor of ten over the four-week monitoring period. The greatest pheromone losses occurred during the first week post application; however, measurable amounts were still present on most of the foliage samples at the end of four weeks.

These results suggest that a single application of E11-14:Ac at 10 g to 75 g per acre can significantly disrupt communication in sparganothis fruitworm. Considering the rapid decrease in pheromone levels in the air and foliage samples, multiple applications of the encapsulated formulation at two-week intervals at low rates (about 5 to 10 g per acre) may be an effective strategy to maintain high levels of pheromone titre.

Two rates of *Trichogramma* egg parasitoids—0.75 million and 1.5 million per acre—and a control were evaluated in a replicated field trial to suppress spotted fireworm egg mass populations. Parasites were released from 16 4'x 4' grid release stations per plot from screened PVC tubes that were 20 cm x 8 cm in diameter. Parasites were released in three installments coinciding with approximately 30%, 50%, and 75% egg laying. Each treatment was replicated three times in 2.5 acre plots. Egg masses were sampled twice, the first time near 50% egg hatch and again at 100% egg hatch.

The rates of parasitism of egg masses by *Trichogramma* egg parasitoids were significantly higher in the *Trichogramma* released plots at both rates evaluated than in the control plots. The percentage of egg masses parasitized was only marginally higher at the higher parasitoid release rate of 1.5 million per acre than the lower rate of 0.75 million per acre. Although the percentage of egg masses parasitized in the parasitoid treatments was high (86.9% to 96.2%) the percentage of eggs parasitized per egg mass was only in the range of 27.4% to 42.5% in the two treatments. Parasitoid emergence in the field was less than 80%.

For objective three: Tebufenozide was incorporated into an artificial diet and bioassays were conducted with neonate and fourth-instar sparganothis fruitworm and spotted fireworm. Mortality was recorded at 10 and 14 days after the initiation of the bioassay. These studies indicated that both these species are very susceptible to tebufenozide. In both, first-instar larvae were more susceptible than fourth-instar larvae. Egg masses of both species were dipped in seven different rates of tebufenozide. No ovicidal activity was seen at any of the rates tested. Preliminary analyses of the data suggest that sparganothis fruitworm was more sensitive to tebufenozide than spotted fireworm, especially at the lower rates tested.

Potential Contributions and Practical Applications

This project is expected to reduce the use of organophosphate insecticides and encourage growers to use sustainable pest management methods. The actual reduction in pounds of organophosphate insecticide per acre will be estimated in the final year of the project. The data generated on the mating disruption of sparganothis fruitworm under this project formed the basis for a registration petition currently in review at USEPA. Similarly, the work on tebufenozide conducted under this project formed the basis for a Section 18 petition approved by the EPA for the use of tebufenozide against blackheaded

fireworm in cranberries in New Jersey for the 1998 season. More than 320 acres were treated with tebufenozide in 1998 in New Jersey, resulting in a reduction in organophosphate insecticide use on at least that many acres.

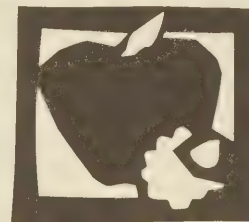
The strategies developed under this project have potential in replacing the use of registered organophosphate insecticides such as Lorsban (chlorpyrifos), Guthion (azinphos-methyl), and Orthene (acephate). There are no registered alternatives to these organophosphates in cranberries except for tebufenozide, which was granted a Section 18 registration for the 1998 season. Further, the use of organophosphates is under scrutiny by EPA under the provisions of the Food Quality Protection Act of 1996.

Dissemination of Findings

Results of this work were presented at the American Cranberry Growers Association Annual meeting attended by approximately 60 cranberry growers. Additionally, the results were presented at the annual field day, which was attended by 60 growers.

The target audience for our outreach program is cranberry growers, Cooperative Extension personnel, Ocean Spray IPM personnel, and private IPM consultants in both Massachusetts and New Jersey. Research results will be communicated at grower meetings, field days, and via newsletters, and the results of this work will also be presented at the annual Ocean Spray grower workshop and at the biennial North American Cranberry Research and Extension Workers Meeting to be held in Washington in October of 1999.

Reported January 1999



Integrating High Density Orchards & Biointensive Integrated Pest Management Methods in Northeastern Apple Production

Summary

This project focuses on integrating advances in management of four key pests—the disease flyspeck, and the insects plum curculio, apple maggot, and European red mite—that still require significant pesticide inputs. Together, these four pests account for at least 70% of pesticide application to Massachusetts apple trees managed under first-level Integrated Pest Management (IPM). This research is aimed at eliminating or greatly reducing all summer pesticide use in Massachusetts and northeast apple orchards.

Objective

- ◆ To eliminate or greatly reduce summer pesticide use in apple trees of differing planting densities, thereby providing a commercially viable, advanced, biointensive IPM system to growers.

Results to Date

Captures of plum curculio (PC) by unbaited trunk-mimic and twig-mimic traps do not correlate with the extent or timing of fruit damage caused by PC.

Blocks of apple trees that received little or no fungicide after mid-June had significantly more flyspeck compared to blocks managed under first-level IPM practices.

Evaluation of fruit harvested from the different density and IPM level blocks showed no significant differences.

Biologically-based practices for control of apple maggot hold great promise for use in the high-density plantings that will likely dominate orchards of the future.

Biodegradable pesticide-treated spheres performed about as well as sticky spheres and nearly as well as three insecticide sprays in controlling apple maggot.

Methods and Findings

With this research and demonstration project, we have entered a third level of IPM in apples. The first level (1978 to 1986) brought a 30% reduction in pesticide use as growers worked with researchers to develop pest management practices based on the monitoring of pest abundance and weather conditions instead of prophylactic, calendar-based spray programs. Our efforts were integrated within but not across the disciplines of entomology, plant pathology and weed science. The second level of apple IPM (1987 to 1996) integrated practices across all relevant disciplines and promoted biologically-based approaches to replace pesticides. Growers using these methods were able to reduce pesticides by 50% as compared to non-IPM orchards.

In 1997, we entered the first phase of third-level IPM, which was an integration of all pest management practices with all horticultural practices used in the production of apples. During the 1997 and 1998 seasons, we studied the influence of apple tree architecture and planting density on biologically-based pest management and fruit quality in 48 commercial blocks in Massachusetts. In each of eight orchards, six blocks of trees were dedicated to the study: two of

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Collaborators

Cornell University
Massachusetts Apple Growers
University of Massachusetts

SARE Grant

\$121,535

Match

\$53,973

Duration

1997 to 2000

Project number

LNE97-90

**MA
NY**

high-density dwarf trees; two of medium-density medium-sized trees; and two of low-density large trees. Half of the blocks were managed with first-level IPM practices and the other half according to third-level IPM practices. Results for 1997 to 1998 are highlighted below.

Unbaited black pyramid traps (trunk mimics) and cylindrical canopy traps (twig mimics) were used to capture PC as they moved into the 48 experimental blocks of apple trees. Every three or four days, from petal fall until the end of June, we examined fruit in each block for evidence of injury in order to draw a correlation between trap captures and incidence of fruit injury. Our results in 1998 confirm and extend our 1997 findings, indicating that captures of PC by unbaited trunk-mimic and twig-mimic traps do not correlate with the extent or timing of fruit damage caused by PC. Extensive, season-long testing of the elements comprising the odor of plum fruit has yielded two compounds that are highly attractive to PC. These, in conjunction with modified versions of the above trap types, offer strong candidate visual and odor stimuli for use in monitoring PC in 1999.

Incidence and severity of the disease flyspeck was monitored weekly in the 48 blocks, in conjunction with a study of season-long orchard climate data and frequent spot readings of weather phenomena. Blocks of apple trees that received little or no fungicide after mid-June had significantly more flyspeck as compared to blocks managed under first-level IPM practices. In 1997, the small trees in high-density blocks had less flyspeck than the larger, less densely planted trees. These differences were not significant in 1998.

Canopy microclimate and plant surface temperatures were warmer and relative humidity was lower in the small trees. As flyspeck develops under conditions of extremely high humidity, these small,

high-density trees may be less susceptible to summer diseases.

At harvest, fruit from the different density and IPM level blocks were evaluated for weight, color, pressure, sweetness, and block-specific crop density. Significant differences were not found among these treatments.

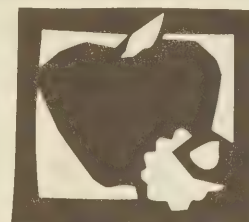
Spray penetration into tree canopies was measured using water-sensitive cards placed at six locations in trees of the three sizes and planting densities. Preliminary results indicate that less spray mix is able to penetrate the canopies of low-density large trees than high-density dwarf trees. Further reductions in volume of spray could be achieved in the high-density plantings.

A survey of the static characteristics of each block of apple trees was correlated with flyspeck injury. The most significant factors were canopy density, density of flyspeck hosts in border areas, lack of slope of the ground, and number of wooded or shrubby borders around the block of apple trees.

A flyspeck prediction model is being developed with project results. The relationships between flyspeck incidence and severity and static orchard factors, planting density, IPM level, canopy density, climate, microclimate, and maturation and movement of ascospores and conidia in and near orchards are being explored in subroutines of the model and will be tested during the next growing season.

Red sticky spheres baited with synthetic fruit odor were placed around the perimeter of every third-level IPM block to trap immigrating apple maggot flies. The efficacy of these traps was compared with the level of apple maggot control gained using three insecticide sprays in the first-level IPM blocks. Apple maggot control under third-level IPM practices was comparable to blocks receiving three insecticide applications. This supports our 1997 findings that biologically-based practices for control of apple maggot hold great promise for use in the high-density plantings that will likely dominate orchards of the future.

Reported December 1998



Biological Control for Soil-Dwelling Insects and Diseases in Strawberries

Summary

This project's goal is to extend the expected life of a strawberry planting and improve the economics of perennial strawberry production. It will investigate the use of beneficial nematodes and fungi to control black root rot and black vine weevils.

Objectives

- ◆ To determine whether applications of entomopathogenic nematodes will suppress lesion nematode and root knot nematode populations.
- ◆ To determine the optimum application timing, rate, and species of entomopathogenic nematodes to reduce black vine weevil populations.
- ◆ To determine whether *Trichoderma harzianum* will protect strawberry plants from black root rot caused by lesion nematodes and *Rhizoctonia fragariae*, and whether *T. harzianum* will interact with insect pathogenic nematodes in preventing damage from black vine weevils, lesion nematodes, and *R. fragariae*.

Abstract

The productive life for a strawberry field in a perennial cropping system can be severely limited by the buildup of debilitating pests. Among these pests, lesion nematodes (*Pratylenchus penetrans*) can cause the most dramatic and rapid loss in productivity. This occurs through their interaction with both *Rhizoctonia fragariae*, which causes black root rot, and black vine weevils (*Otiorhynchus sulcatus*). The destruction of roots causes mortality and loss of vigor, sometimes only two to three years after planting. These two pests are particularly difficult to manage due to insecticide resistance and the loss of soil fumigants.

Current recommendations suggest plowing fields and replanting, with the associated loss of one fruiting year with each year of planting. Insect pathogenic nematodes, *Steinernema carpocapsae* and *Heterorhabditis bacteriophora*, kill black vine weevil larvae and pupae, and may also suppress plant parasitic nematodes. These commercially available beneficial nematodes may limit the intrinsic rate of pest population growth and provide negative feedback to their development. If so, these nematodes could prolong the expected life of a planting and improve the economics of perennial strawberry production. The interaction of insect pathogenic nematodes and the biological control fungus, *Trichoderma harzianum*, will also be investigated to determine the efficacy of the beneficial fungus and nematodes against black root rot pathogens.

Approved for funding March 1998

Coordinator

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Collaborators

Connecticut Agricultural Experiment
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Cornell University
Jones Family Farm
University of Connecticut

SARE Grant

\$147,557

Match

\$82,379

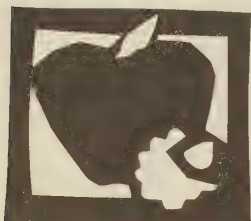
Duration

1998 to 2001

Project number

LNE98-106





Integrated Management of Cranberry Insect, Weed & Disease Pests Using Fall & Spring Floods

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Collaborators

University of Massachusetts
Massachusetts cranberry growers
Ocean Spray Cranberries

SARE Grant

\$130,000

Match

\$122,146

Duration

1999 to 2002

Project number

LNE98-107

Summary

This project will continue investigations into the use of flooding for the integrated control of cranberry weed, insect, and disease pests. Participants will examine the effects of fall, spring, and short post-harvest sanitation floods on key cranberry pests and crop productivity.

Objectives

- ◆ Evaluate the effects of fall flooding for up to six weeks post-harvest on cranberry fruitworm, severe soil grub species (oriental beetle, *Hoplia*, and cranberry girdler), perennial weeds, fruit rot disease, phytophthora root rot, and cranberry growth and yield.
- ◆ Examine the use of a shorter, two-and-a-half week spring flood for control of southern red mite and cranberry fruitworm, and determine the impact of this flooding on the incidence of fruit rot disease, cranberry growth and yield, and the ability to safely use post-flood preemergence herbicides.
- ◆ Assess the effectiveness of sequential fall-winter-spring flooding to control *Rubus* weed species.
- ◆ Evaluate the use of a short-term trash-removal flood subsequent to dry-harvest as a cultural control for cranberry fruitworm, cranberry girdler, and fruit rot disease.

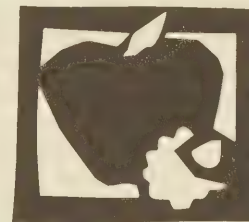
Abstract

Cranberries are the number-one horticultural commodity in Massachusetts, with a farm gate value of \$110 million. In addition to 14,000 acres under production, cranberry growers control more than 60,000 acres of support lands in association with their bogs. These farms represent a significant portion of the remaining open space in southeastern Massachusetts, preserving valuable wildlife habitat and water recharge areas. However, as for many commodities, cranberry production remains dependent on the use of chemical pesticides.

This project will examine the use of flooding for the integrated control of cranberry weed, insect, and disease pests. The goal is to extend our current knowledge of the impact of flooding on certain key pests and develop a strategy for reduced-pesticide management that minimizes adverse cranberry crop and plant impacts. We will also examine the effects on cranberry growth and yield, to assure the pest control has no adverse effect on crop productivity. The project will also explore shortening the flood duration to evaluate impact on cranberry yield.

Approved for funding March 1998

Adaptive Nitrogen Management in Orchards: Developing Soil & Ground Cover Management Systems that Optimize Nitrogen Uptake, Retention & Recycling



Summary

This project will develop a detailed, year-round model for nutrient uptake and release in an experimental orchard where four different ground cover systems have been established since 1992. Participants will then adapt the ground cover management systems for more efficient nitrogen management and to minimize nitrogen losses. Results will be made available to the apple industry.

Objectives

- ◆ Determine the effects of different groundcover management systems (mowed turf grass, wood-chip mulch, and pre- and post-emergence herbicides) on the critical components and phases of nitrogen (N) release, uptake, retention, and recycling in a northeastern apple orchard.
- ◆ Integrate and synchronize groundcover vegetation management in relation to critical periods of fruit-tree N demand, managing the groundcovers to prevent erosion and retain excess N during periods of low crop demand, in order to minimize N losses from orchards.

Abstract

Orchards are often located on well-drained soils near aquifers and bodies of fresh water. Agrichemical contamination of surface water and groundwater is a potential problem in these sites. N pollution of water resources has proved to be a serious problem in many fruit-growing regions, and could be reduced by more efficient N management. Various soil and ground cover management systems (GMSs) are used in orchards, and because they affect the amounts of soil water and nutrient uptake, retention, and loss, they could be adapted and used to help prevent N pollution. We propose to develop a detailed year-round N budget and flow chart for the major components of an apple orchard where mowed red fescue sodgrass, hardwood bark-chip mulch, and pre- and post-emergence herbicide strip GMSs have been maintained under 330 trees since 1992. An existing field-scale leaching and runoff monitoring system and extensive sampling of soil, root, shoot, and leaf tissue in trees and groundcover vegetation will provide new and holistic information on the movement and cycling of N within orchards.

Approved for funding March 1998

Coordinator

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Collaborators

Cornell University

SARE Grant

\$153,505

Match

\$146,838

Duration

1999 to 2001

Project number

LNE98-98





marketing



Commercial Small-Scale Food Processing in New York: Value-Adding for Sustainable Agriculture Marketing

Summary

This project address small-scale food processing as a way to enhance farm income, rural employment, and quality of life. It particularly address issues of policy that can enhance or impede the success of small-scale processing.

Results from previous years suggest that successful small-scale processors have developed unique, attractive products in which quality is consistently high; they then market these products creatively by having sound business plans and correct assessments of potential markets. Barriers to success tend to be similar to the barriers to other small businesses. One of the important results of the project has been the development of a statewide food processors' organization to promote networking and cooperation.

Objectives

- ◆ Establish a database to track farmer and other entrepreneurs starting and operating small-scale food processing businesses in New York.
- ◆ Develop a classification of small-scale food processing businesses according to whether they are farm-based or non-farm-based, and according to their assistance needs, income or sales classes, and types of products.
- ◆ Identify the keys to success in small-scale food processing, and the barriers.
- ◆ Develop a series of case studies of processors.
- ◆ Assess the need for and interest in a trade association in New York or the Northeast specifically for small-scale processors. Facilitate the establishment of such an organization, if justified.
- ◆ Develop strategies that communities can use to promote local development through small-scale food processing.
- ◆ Organize a statewide conference for small-scale food processors to meet with food scientists, policy makers, and regulators to discuss issues and concerns and share information.
- ◆ Develop policy recommendations.

Background

This project evolved from a collaboration between the New York Sustainable Agriculture Working Group and the Cornell Farming Alternatives Program. Since inception, the project has developed a database of over 5,000 farmers and entrepreneurs starting and operating small-scale processing operations. Extensive networking, mentoring, case-study, and support efforts have taken shape.

Behind these efforts is an awareness that increasing on-farm efficiency may not be enough to sustain farms and farming communities in the Northeast. Small-scale processing, specifically on-farm processing, allows farmers to capture more profit and meet consumer demand for local and specialty products; the model may also encourage job creation, and tends to keep local dollars circulating in the community.

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Working Group
New York Department of Agriculture
and Markets
New York farmers and food processors

SARE Grant

\$63,881

Match

\$15,734

Duration

1995 to 1998

Project number

LNE95-60



Key Findings

During the final year of this project, we have developed case studies of several processors and food processing incubators (FPIs). FPIs, which support small processors, are proliferating throughout the United States. Some of these case studies appear in a publication, "Value-Adding for Sustainability: A Guidebook for Cooperative Extension Agents and Other Agricultural Specialists," co-authored with the Pennsylvania Association for Sustainable Agriculture (PASA).

Technical training, product development facilities, advertising, product distribution, supply purchases, consumer education, and the acquisition of group insurance all continued. There has also been a new initiative in which we formed an association with regional chapters, each representing one tourist region of New York, capitalizing on the established identity of that region. We currently have six regional chapters initiated and contacts for four additional regional chapters. Work on this objective will continue after the project ends because the organization is considering how it could be extended to the rest of the northeastern states. In addition, we collaborated with PASA on developing resources to help potential processors, and we participated for two years in workshops at their annual meeting. The first workshop was for current and potential processors and the second was for Cooperative Extension agents and other agricultural professionals.

Operational Recommendations

Since we began working on this project, we have learned much about small-scale food processing and what makes such enterprises successful. The successful entrepreneurs are often those who develop attractive and unique products, devote attention to detail, produce high-quality products, market these products creatively, correctly assess potential markets, have sound business plans, and have good matches between their own characteristics and their businesses. We have also identified eight key needs faced by many potential and operating small-scale food processors.

- Most need processing technical support for developing procedures for processing high-quality, safe foods.
- Most need regulatory technical support to help them get permits and comply with regulations.
- Most need facilities technical support to assist

them in finding, installing, operating, and maintaining processing equipment.

- Most need assistance in finding sources of new or used equipment appropriate for their scale at prices realistic for small and startup enterprises.
- Most need marketing technical support for developing markets, selling their products at a good price, and creating distinctive and attractive product identities through packaging and advertising.
- Most need financial support for funding startup, expansion, or modernization, either in loans or in assistance in getting funds from commercial sources.
- Most need labor technical support, including assistance in managing business and family life, and many need assistance in managing and motivating employees.
- Many need business support, including assistance on operating a business, getting liability insurance, trademarking, maintaining financial records, and meeting tax and labor regulatory requirements.

To meet the needs of small-scale food processors and to harness the potential small-scale food processing in supporting agriculture in the Northeast, we have developed a set of policy recommendations for local, state, and federal governments. These recommendations include adding staff in the state department of agriculture to support farm-based enterprises, expanding technical support, improving the availability of grants and revolving loan funds, creating an insurance pool for small processors, integrating technical support with business support, linking small-scale processing with tourism, funding research on scale-appropriate marketing and other topics pertinent to the food processing business, and building regional labels and identities while avoiding excessive bureaucratic interference.

Other policy recommendations include making small-scale food processing an explicit element in sustainable economic development programs, developing and printing an annual directory of small-scale processors, and making health insurance affordable for families and employees in small business. At the federal level, the creation of new intellectual and other property institutions would give small businesses more protection against the appropriation of their ideas and, at the state or federal level, the creation of program patterned after the SARE farmer grants that offer support to innovators.

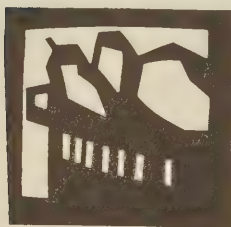
While we make many recommendations about what should be done to promote small-scale food processing, we also have considered what to avoid. In developing policies and implementing them, we need particular efforts to avoid promoting wholesale adoption of a few particular types of enterprises (such as making holiday wreaths, for example) that can lead to overproduction and a subsequent decline in profitability among the producing firms. The products should reflect the skills and interests of the producers and the local ecological

and historical niches of the producers' communities. We should also avoid focusing on economic efficiency as the main criterion for evaluating local entrepreneurial efforts—most products could be produced elsewhere more cheaply. But this production would not yield for the local community a host of benefits, including giving people access to local specialties, involving local people in meaningful work that integrates them into their communities, and generating secondary economic activity for supporting other businesses.

Reported December 1998

Project number

LNE95-60



Community Supported Agriculture: Research & Education for Enhanced Viability & Potential in the Northeast

Coordinator

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Collaborators

CSA of North America
Massachusetts and New York farmers
University of Massachusetts

SARE Grant

\$159,000

Match

133,033

Duration

1996 to 1998

Project number

LNE95-63

Summary

Community Supported Agriculture (CSA) may well be the key to the future of small farms and the sustainability of local food producers. This project is taking the first in-depth look at the economic viability of CSAs in the Northeast and is establishing ways to provide direct education and mentoring to CSA farmers.

Objectives

- ◆ Determine the extent to which CSA constitutes an economically viable production and marketing strategy in the northeast region.
- ◆ Print an annual CSA Farm Network publication to link CSA projects with area specialty production farms and resource providers and disseminate research-based information.
- ◆ Provide direct education and mentoring to CSA farms to help solve specific CSA problems through peer education and mentoring, network development and improved connectedness, and support for CSAs and their viability in the Northeast.

Findings to Date

Early analysis suggests that CSA operators do cover explicit cash costs with their CSA share price, but that costs associated with operator labor and fixed inputs are not adequately covered by CSA share prices.

CSA operations that have a core-group organization were more likely to cover the total costs of the operation.

The study suggests that CSA farmers can cover the full costs of production and still provide consumers good value for their share.

Method and Findings

Cost and return data were collected from northeast CSA operations for 1995, 1996, and 1997. The 1997 survey resulted in completed questionnaires from 34 CSA operations, a response rate of about 31%. These data have been merged with the observations for 1995 and 1996.

One issue that arose in each of the survey years was the length of the survey and the detail that was requested. While the length of the survey form clearly inhibited participation, the information was crucial to our findings. For example, it would not have been possible to compute the full economic costs of production without the detailed information on operator and hired labor hours of work. The long-term viability of CSA operations, as with any farm, depends upon covering the full economic costs of production.

On average, share prices charged by CSA operators did cover the cash costs that were reported in their survey responses. In 1995, the average share price was about \$445, while the average reported costs were \$408.50. The average 1996 share price was \$460 while costs were \$365. This is consistent with the CSA concept; the share price should cover the farm's budget. However, further analyses suggested that CSA operations in 1995 and 1996 did not cover their full costs of production when pricing their shares. One very important component of cost is the wage paid to the farm operator. A number of operators were not paid a competitive wage for the hours spent working at the CSA. We



imputed additional wages of \$197 for labor in 1995 and \$163 in 1996. When these additional costs are added to the CSA budget, the share prices would need to be higher by \$160 in 1995 and \$68 in 1996.

Research on valuing CSA shares, which was completed during winter 1997, was published in the 1997 *CSA Farm Network*. Retail values computed for three CSA operations in the Amherst, Massachusetts area for 1995 indicated that retail values were as much as double the CSA share prices. Coupling these findings with the results of our research on costs of production, we find at least anecdotal evidence that CSA operators should be able to cover their full costs of production.

This data provides useful budget information for farmers, both CSA operators as well as those considering CSA as an option. From the survey, we are able to create profiles of operator, hired, and unpaid labor requirements by month. These profiles will provide total labor requirements per share to guide CSA operators in predicting their labor requirements at different times of the growing season. One important part of CSA operation is developing an accurate budget in order to determine share price. These cost and return data are important for that planning process.

These analyses are some of the first conducted for CSA operations and will be useful to other researchers and Cooperative Extension personnel in advising on CSA budgeting issues. CSA farms seeking finances for the purchase of land, machinery, and other capital items needed for production have found the lack of knowledge about CSA by traditional agricultural lending institutions to be a problem that this data can help resolve.

We considered the organization of the CSA as a factor that may affect success. The two broad categories were core-group and non core-group CSAs. This is reasonable given that core groups often work with the grower in establishing the share price and share composition. Core-group CSA operations were typically large in 1995 and 1996. The average amount of product per full share was 510 pounds for core-group farms in 1996 whereas the non core-group CSAs provided about 340 pounds per full share.

These quantitative differences were apparent in the price of a full share. Core-group farms charged \$487, on average, while non core-group farms

charged \$350 on average. However, the price per pound for core-group farms was lower, \$0.95 per pound versus \$1.03. Eleven of the 23 CSAs in 1995 had a core group. Seven of those CSAs had income that met or exceeded costs. Of the twelve non core-group CSAs, only two had income that met or exceeded costs. In 1996, a similar picture emerged. These statistics suggest that core-group CSA operations were more likely to be viable.

Core-group CSAs were larger operations, and to assess whether the use of a core group was a causal factor in farm success required multivariate statistical techniques. The results indicated a number of expected results. Larger farms had higher net incomes and human capital measures, as well as experience and education. Both of these resulted in higher net income as well. Importantly, we did find that core-group CSAs had higher net incomes by more than \$7,000, even after controlling for farm size and human capital measures for the operator.

Little theoretical work has been done on CSA decision making. We focused on models that link operator preferences or beliefs with production decisions and models of cooperation. We saw that a number of CSA farms did not cover full economic costs; in the theoretical model, we considered parameter requirements that would trigger these results. The model revealed that the farmer may accept a less than desirable outcome, in terms of net returns, if the farmer felt significant "warm-glow" effects from production. These "warm-glow" effects would be due to a commitment to the CSA concept or through sustainable or environmentally safe production.

The conclusion is consistent with community benefits that the CSA farmers reported in open-ended survey questions. For example, 63% of the 1995 CSAs responded that preserving the environment was an important benefit they provided. Equally important in 1995 was the use of CSA as an educational and outreach tool for the community. In addition, 40% or more of CSAs in both 1995 and 1996 reported that integrating the community was an important benefit that their CSA provided.

The 1997 *CSA Farm Network* was published in February 1998. This 92-page book, complete

Project number

LNE95-63

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LNE95-63

with articles, research papers, a resource directory, and a CSA directory for the Northeast, was widely distributed, and each of the 500 CSA operations in the directory received a copy. The *CSA Farm Network* publications have resulted in increased contact with CSAs in other parts of the country, particularly the South and Midwest, as well as with researchers interested in CSA. The network established for CSA has grown far beyond the northeast network that was originally envisioned.

The Northeast CSA Conference culminated this portion of the project. The conference, entitled "CSA: Building A Future for Farming in the Northeast," was held November 7 and 8, 1997, in western Massachusetts. More than half of the 320 participants were CSA growers or current farmers

thinking of moving in the direction of CSA. The remaining participants were CSA members, university, USDA and extension personnel, and members of the general public. All states in the Northeast region were represented, as well as Alaska, Florida, Minnesota, Montana, California, Washington, Oregon, Ohio, Tennessee, Michigan, Illinois, and Wisconsin. The conference also attracted an international audience with attendees from Japan and Canada.

The work completed on this part of the project over the previous two years overwhelmingly points to the continued support and enthusiasm for CSA in the northeast region as a viable farming alternative.

Reported December 1998



CORE Values Northeast: A Northeast IPM Apple Consumer Education & Market Development Project

Summary

Mothers and Others is working in the northeast region to create a supportive market environment for products that are grown by local farmers striving to maintain healthy, ecologically balanced growing environments. This project centers around an eco-label and farm certification program for apples that are locally grown using biointensive Integrated Pest Management (IPM) methods. CORE Values Northeast (CVN) is generating greater consumer awareness of the benefits of local, environmentally grown foods and is improving market opportunity for local, ecologically grown apples. In this way, CVN is increasing orchard acreage under ecological management while strengthening economic and community well-being.

Objectives

- ◆ Establish a supportive market environment for ecologically grown and certified apples.
- ◆ Generate greater consumer awareness of the benefits of local, environmentally grown foods.
- ◆ Develop a model knowledge-based certification program to accredit northeastern apple growers utilizing biointensive IPM production methods on their farm.
- ◆ Identify and seek to address market barriers that could impede expansion of the CVN program and limit the supply of quality fruit grown according to environmental standards.
- ◆ Increase orchard acreage under ecological management in the Northeast.

Key Results

CVN currently has 24 growers and over 3,000 acres in production.

CVN has launched a site on the World Wide Web for farmers and consumers.

Mothers & Others will undertake a comprehensive evaluation of the CVN project in 1999. It will address the impact CVN has had upon environmental improvement in northeastern rural communities, the economic benefit received by the CVN farmers, and whether CVN is self-sustaining.

Methods and Results

The ecology and weather conditions of the northeast region make organic apple production extremely difficult. This fact inspired the creation of a biointensive IPM—rather than an organic labeling program—in order to realistically encourage pesticide reduction.

Applying a “market pull” strategy, CVN is building consumer demand for, and producer and market supply of, ecologically branded fruit. A regional eco-label that generates strong market pull is inspiring many growers to reduce pesticide use in order to meet the label’s ecological standards. In so doing, this program serves the needs of the farmer, the land, the local economy, the consumer, and future generations.

This eco-label is providing an important vehicle to educate consumers about environmental improvements being applied in food production. By creating an option, CVN enables consumers to apply socially held values to purchasing decisions. In this way, eco-labeling becomes an

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Collaborators

Apple growers from Massachusetts,
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New Hampshire

Bread and Circus

D’Agostino Supermarkets

Massachusetts Department of Food and
Agriculture

Mothers & Others

Northeast McIntosh Growers Association
NRCS

Tufts University

University of Massachusetts Extension
System

SARE Grant

\$20,000

Match

\$150,000

Duration

1997 to 1998

Project number

LNE97-88

MA, CT, NY, VT, NH

important part of a larger effort to strengthen alternative economies that support local producers, sustainable agriculture, and regional economies.

CVN currently has 24 growers and over 3,000 acres in production. With a pared-down mailing list of over 180 prospective farmers, we are working to significantly increase the number of farmers who join the program by encouraging them with increased market opportunities. Another attraction is the support of the growing community of CVN farmers who provide each other, formally and informally, with technical assistance on the reduction of harmful chemicals in production practices. We are currently advocating for increased research to help CVN growers experimenting with alternative pest management strategies.

CVN apples are currently distributed through farmers markets and several supermarkets including D'Agostino's (New York), Big Y (New England), Kings (New Jersey), and Bread and Circus (New England). As of this fall, the apples are also distributed in all 160 Manhattan public schools, which serve 75,000 children 600 cases per week. Through our work with a private school food service provider, CVN apples are now available in several Long Island public schools as well as 24 private schools in New York City. Continual efforts are necessary in order to ensure these markets for the future as well as expand the marketplace for CVN apples.

The certification process is made up of a knowledge-based farm plan that outlines all major aspects of orchard production, including weed, disease, and pest management. The farm plan is reviewed by the CVN certification committee, which is made up of two Cooperative Extension agents and IPM specialists, two farmers, a consumer representative, and an independent IPM consultant. The

plan also includes a third-party annual inspection of all CVN farms and attendance at annual meetings to exchange knowledge among the CVN growers.

The official CORE Values Northeast web site (www.corevalues.org) launched on September 1. The web site is divided into two categories—farmers and consumers. It includes information geared toward children, parents, teachers, and growers. One CVN grower has already commented: "I've received a lot of calls this week from people asking for my apples—people who found out about them through the new CVN web site."

We expect to prove there is enough market support to sustain all aspects of the CVN program, including certification, consumer and retail education, and market development. We are working to promote the CVN program to growers and their support community within the state and the federal agricultural system in the hopes of ensuring long-term security for the program.

As a model project, we expect that CVN can be replicated and used on other commodities in other communities. Transferable CVN strategies are now being applied to a national organic cotton fiber project as well. Through the distribution of our educational materials, through lectures and speaking engagements to a wide variety of audiences, and through active networking among the larger eco-labeling and agricultural communities, CVN will ensure that its experience and information will be transferable to other communities.

In 1999, Mothers and Others will undertake a comprehensive evaluation of the CORE Values Northeast project. This will be the first critical review of an eco-label, and will analyze its goals, methodology, and results. It will include both qualitative and quantitative analysis, and provide information on the costs and benefits to farmers.

Reported December 1998



Farmer-Centered, Value-Added Processing & Marketing Opportunities for Northeast Dairy Farmers

Summary

Cheese, yogurt, and butter are just a few of the products farmers can consider making as alternatives to shipping raw milk. This project is examining the potential of farmstead dairy processing and marketing enterprises. The investigation is considering how such businesses can be an economically and socially sustainable option for small- and medium-size dairy farms in the Northeast.

The scope includes analyzing a variety of existing Value-Added Dairy (VAD) businesses, developing case studies, constructing engineered budgets, identifying relevant resources, producing a guide book for farmers, undertaking a feasibility analysis with prospective VAD farmers, and holding a Northeast VAD opportunities conference.

Objectives

Research

- ◆ Identify keys to success and potential barriers among milk producers and handlers, farmstead dairy manufacturers, and innovative value-added processing and marketing enterprises, especially among those dairies using cow's milk.
- ◆ Develop and publish a series of case studies of six to ten successful enterprises, both farmstead (producer-handler and producer-manufacturer) dairy operations and other farmer-centered, value-added dairy processing and marketing operations.
- ◆ Develop and publish (with a case study report) engineered economic and labor budgets for various types of farmer-centered value-added dairy processing and marketing enterprises.
- ◆ Catalog and characterize land grant, Cooperative Extension, community economic development, organizational, and entrepreneurial activities, especially in the Northeast, that support the development of farmer-centered, value-added processing and marketing enterprises.

Development and Education

- ◆ Organize the research and development work around the questions and involvement of stakeholders (interested dairy producers, community economic developers, and agency and organizational representatives), using a Participatory Action Research framework.
- ◆ Produce and disseminate a guidebook on several milk processing and marketing alternatives for prospective producer-handlers and specialty processors.
- ◆ Determine the potential availability of components (excess processing capacity, used processing equipment, grant and loan opportunities, and consumer demand areas) needed for development of new farmstead and farmer-centered dairy processing operations.
- ◆ In partnership with one or two geographically clustered groups of interested dairy farmers, conduct an exploratory prefeasibility study of possible farmer-centered, value-added dairy enterprises, to include a field investigation of marketing opportunities.
- ◆ Organize a conference on farmer-centered, value-added processing and marketing opportunities for northeast dairy farmers.

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Collaborators

Cornell University
First Pioneer Farm Credit
New York State Department of
Agriculture and Markets
South Central New York RC&D
Watershed Agricultural Council

SARE Grant

\$53,000

Match

\$17,500

Duration

1997 to 2000

Project number

LNE97-89



Results to Date

Those VAD businesses that thrive have a good fit with the family, land, geography, and financial base and have articulated a clear, focused business identity and goal.

Successful VAD farmers generally produce superior quality milk.

Some small VAD farms provide the largest single source of farm household income.

While the high cost of new processing equipment can be a roadblock, resourceful farmers continue to acquire used equipment.

The information gained through this project has helped many farmers decide whether to pursue a VAD business for their farm, sometimes after years of dreaming about processing their own milk.

Methods and Findings

The precipitous decline in the numbers of dairy farms, the related need to revitalize rural communities, and the growing consumer interest in specialty foods direct from farms has provided strong motivation for this project. Our research shows that VAD enterprises can be energizing, profitable, and successful businesses for farms of a variety of sizes, including microenterprises, engaging additional family members in earning farm income. Conversely, VAD businesses may also be demanding, complicated ventures that fit poorly with the reality of dairy farming.

In addition to serving as a vehicle for the survival of a number of dairy farms and the entry of a next generation of owner-operators into agriculture, VAD farms can be anchors for community agricultural development. As unique small businesses that by definition must market themselves to the public, such farms typically exert a disproportionate positive influence both on the dairy industry and in their communities. VAD farms have the potential of becoming a thriving agricultural sector like farm wineries. Their existence is likely to foster the growth of other small producer-marketers.

VAD farms capture a much larger percentage of the consumer food dollar and much greater value for their milk than goes to other dairy farmers. Because of the presence of a feedback loop between consumer demand and farmer practice, VAD farmers also reap rewards for being responsible stewards. VAD create new jobs, both for farm family members and for outside employees. They provide

opportunities for agritourism and for educating children and consumers about where food comes from and the value of local farming.

We have developed a body of knowledge that helps individuals compare the requirements and relative advantages of producing different types of dairy products and of different marketing strategies. The range of investment involved with establishing a VAD enterprise is tremendous, from under \$5,000 to over \$300,000.

We recommend that dairy farmers interested in setting up a processing plant thoroughly assess their skills, resources, values, and family and business relationships. Poorly managed and heavily indebted farms or those otherwise in crisis are not good candidates. We advise early contacts with state dairy inspectors, other regulators, VAD farmers, and specialty cheesemakers to gain a better picture of necessary steps in establishing a VAD business.

The project functions as an information and referral clearinghouse and has provided orientation and guidance to dozens of farmers as well as agricultural advisors regarding possible VAD opportunities. Farmer participants have gained direction, inspiration, and a sense of reality. Some are now experimenting with making cheese, locating used equipment, and making specific plans to develop their facility and their new business.

Through VAD farmer interviews, site visits, and presentations, we identified a number of keys to success and barriers. Successful VAD farmers often saw their enterprise as a way to employ additional family members productively in the farm business rather than a way to reap a major profit. A key to success is often an extended family that works well together, or, on small VAD farms, couples or partners who can work closely.

Successful VAD farmers generally produce superior milk. The preponderance of minor breeds such as Jerseys among VAD cow farms further differentiates their product from mass-produced milk. Successful VAD farmers may produce milk very efficiently, managing many animals per person per hour. In some cases, exclusive reliance on purchased feed further frees up management time for the VAD enterprise. Farms with a high labor-to-animal ratio are

likely to compensate with a niche market clientele that pays a sufficient price to offset production inefficiencies.

As they consider VAD options farmers would be wise to imagine all possibilities, including milking another species, selling most of the herd, relocating the farm, and finding a partner. Creativity in seeking capital and in deciding to start small is recommended. The determination of the product goes hand in hand with the identification of target market and marketing strategies. Farmstead products cannot compete in price, and must be differentiated from mass-produced foods to the greatest extent possible. Free publicity is normally more effective than paid advertising.

Barriers to success and to starting up new enterprises include federal milk marketing orders (affecting only 'producer-handler' cow dairies selling fluid milk); the required capital investment; the challenge of running multiple businesses (dairy production and field crops, processing, marketing, and distribution); distribution costs (labor and trucking); and the lack of readily available information. Regulations were a significant problem in a minority of situations, while other VAD farmers cited their milk inspectors as a major source of assistance. The absence of familial support, inadequate management skills, lack of marketing orientation, and heavy debt load are common individual obstacles. While the high cost of new processing equipment can be a roadblock, resourceful farmers continue to acquire used equipment. For fluid milk sales, farm location (remoteness, lack of affluent population or potential retail outlets) can pose a significant barrier.

In developing our case study profiles, we found some surprisingly small VAD farms (milking fewer than ten or fifteen cows or less than twenty or thirty goats or sheep) provided the largest single source

of farm household income. Typically, these farms operate almost exclusively with family labor and have minimal financial investment in facilities and equipment. They produce and market a premium, handcrafted product to eager customers.

Some farm couples and extended families are motivated to start a VAD in order to make the dairy farm profitable without massive expansion. A good decision making process, sufficient labor and capital, and sound choice of product and market strategy seem to be paramount.

Start-up strategies included purchasing an existing business, hiring a consultant, taking a short course, and visiting other VAD enterprises. A few creative farmers sold shares in their cows or goats to investors, or coupons ("Moo dollars") for their future product.

The Northeast is the quintessential location for niche market producers. Farmers here are located within easy reach of over 50 million people. Our region's farmers have the potential to capitalize on the growing demand for farm-direct, handcrafted, and other specialty foods with a regional identity. Such "foods with a place and face" are prized by a substantial sector of loyal consumers and are high value for the farmer.

VAD farmers employ a broad range of marketing outlets (mail order, home delivery, catalog sales, farmers markets, supermarkets, convenience stores, brokers, specialty shops, food coops, restaurants, and schools), with varied success. Most have developed a farm and product identity using a logo, label and packaging. None depend on paid advertising as a primary means to attract customers.

We have identified, networked with, and characterized a range of university, extension, community development, private, and state-sponsored activities that educate and assist farmers interested in VAD enterprises. While this list is extensive, many areas are not served by any group or agency with specialized knowledge in this subject area.

Reported December 1998



Markets & Sustainable Agriculture: A Model for Linking Northeast Farms & Urban Communities

Coordinator

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Collaborators

Cooperative Extension of New York City
Farming Alternatives Program
Siembra Project

SARE Grant

\$99,961

Match

\$30,639

Duration

1997 to 1999

Project number

INE97-94

Summary

Marketing is key to the sustainability of agriculture in the Northeast, and assisting producers in tapping new markets is an important role that researchers, Cooperative Extension educators, and community organizations can play. This project is contributing to the knowledge of how ethnic markets in New York City function, where specific market opportunities exist, and how farmers and food buyers can be brought together in mutually beneficial ways.

Objectives

- ◆ Test and demonstrate a methodology, based on the principles of participatory action research (PAR), for identifying and characterizing specific marketing opportunities in urban communities that have significant potential to enhance the profitability of farms in the Northeast.
- ◆ Implement two or three pilot marketing projects to test and demonstrate the ability of extension and non-governmental organizations (NGOs) to facilitate successful marketing relationships linking northeast farmers to ethnic markets.
- ◆ Support the replication of this type of market research and development in other communities by publishing a guide that outlines the PAR process used, results achieved, and experiences of participants over the course of the two-year project.

Findings to Date

We have been surprised that retailers, and restaurants in particular, have not mentioned food items they'd like to carry but could not access.

Many popular items sold by ethnic markets include what might be considered fairly standard items that could easily be supplied from the Northeast.

Our surveys show price is the biggest barrier to carrying different items and higher quality items.

Some retailers, restaurateurs, and wholesalers seem open to working with new sources of supply, including using existing or new brokers, wholesale markets, and farmer-direct purchasing.

Specialty products and value-added opportunities include pre-washed, pre-cut, pre-bagged lettuces for the kosher market, goat meat for the Hispanic market, specialty items for various holidays (especially Jewish holidays), and red veal.

Method and Findings

The overarching goal of this project is to help support the viability and sustainability of northeastern farms and to help urban ethnic food buyers gain access to quality fresh agricultural products. This project is helping the farmers and consumers by researching and testing a new model of mutually beneficial marketing relationships. Practical applications of this information will become clearer through our pilot projects, as extension staff and NGOs work to facilitate the early phases of new marketing relationships and bridge the substantial urban-to-rural and ethnic gulfs that currently exist between producers and buyers.

In the first phase of this two-year effort, project partners set out to test and demonstrate a methodology for identifying and characterizing specific ethnic marketing opportunities, drawing on the



interest, expertise, and involvement of community stakeholders. A first step was to develop a PAR committee made up of project partners and community stakeholders representing various sectors. This included extension agents, farmers, representatives of groups working on agricultural economic development, a chef, a market manager, and a nutrition educator and consumer advocate.

Members of this broad-based PAR committee have been involved in learning about the goals and methods of PAR, refining the research goals of this project, narrowing the geographic scope of research to a manageable size, reviewing and commenting on research instruments for both market-based and producer-based information, identifying key market contacts, and serving as community liaisons throughout the interview process. In future months, the PAR committee will participate in analyzing the qualitative and quantitative market data collected, identify farmers to interview, discuss and select pilot projects, and analyze the results of producer research and pilot projects.

To date, the project partners have conducted 44 market interviews; 20 with retail operations, 10 with restaurateurs, 11 with suppliers and 3 with processors. Partners are currently engaged in a two-layered analysis of the interview results, noting patterns and major findings. From this analysis a narrative report will be developed for the PAR committee to review in January of 1999. PAR committee members will also select pilot projects for phase two of the participatory research study.

As yet, no farmers have changed practices as a

result of this study. It is expected that some changes will be made by farmers in the products they grow or produce, based on market opportunities for such ethnic products as Chinese greens, hot peppers, specialty herbs, meat, and dairy products. Moreover, farmers may well adopt changes in the packaging, value-added processing, presentation, and delivery of new and traditional products as a result of the market research conducted.

Site Information

Thus far, our research efforts have focused not on farms but on market outlets in the Williamsburg section of Brooklyn, New York. The area possesses a wide range of groups (Hispanic, Jewish, African-American, Italian, Polish, and Asian), with both different and shared food needs and preferences. Williamsburg is characterized by diverse income levels and it enjoys community leadership in the form of willing partners like Los Sures/Greater Williamsburg Collaborative, El Puente, and People United for Local Leadership. The location of the community, at the intersection of the Brooklyn Queens Expressway and the Williamsburg Bridge, is also an advantage.

Reported December 1998

Project number

LNE97-94



CORE Values Northeast: A Northeast IPM Apple Consumer Education & Market Development Project

Coordinator

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Collaborators

Apple growers from several
northeastern states
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D'Agostinos
Massachusetts Department of Food and
Agriculture
Mothers & Others
Tufts University
University of Massachusetts
Cooperative Extension
University of Vermont

SARE Grant

\$25,000

Match

\$100,000

Duration

1998 to 1999

Project number

LNE98-101



Summary

Through this project, consumer advocates are working in partnership with progressive apple growers and Cooperative Extension personnel to use consumer education and market incentives to boost demand for local apples, grown according to biointensive integrated pest management (IPM) principles and practices. This grant funds the second year of a three-year project.

Objectives

- ◆ Develop a model knowledge-based certification program to accredit Northeast apple growers utilizing biointensive IPM production methods on their farm.
- ◆ Promote market development of certified apples and positively influence consumers' preference for them.
- ◆ Reward regional producers in the program by increasing their market share and returning preferential prices.
- ◆ Encourage growers' adoption of ecological practices.

Abstract

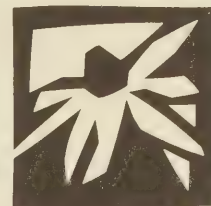
CORE Values Northeast (CVN) is a three-year project of Mothers and Others for a Livable Planet, a consumer education and advocacy organization, to increase market opportunities for sustainably produced food. This model eco-labeling program, introduced in 1996, brings together northeast apple farmers and consumers as partners in defining ecologically responsible agriculture through the accreditation of regional farmers using biointensive IPM. Project partners are working to build public awareness of and demand for local, ecologically-grown apples, using consumer-centered media and market-based education strategies.

Increasing consumer demand for ecologically-grown apples through education is likely to result in increased market share and better prices for ecologically-grown apples, and increased interest in adoption of standardized ecological methods by orchardists. If this program is successful, it will lead to greater economic viability of the northeast apple industry, greater use of ecologically-based orchard management practices, and environmental and social benefits accruing from stronger markets for northeastern apples.

Approved for funding March 1998



ornamentals



Flowering Plants to Enhance Biological Control in Landscapes

Summary

Using biological insect pest control strategies, the participants are investigating ways to enhance beneficial insect populations through strategic plantings of flowering plants in urban landscapes. The study focuses on predators and parasites of the azalea lace bug. The goal is to develop alternative reduced-pesticide management methods that are practical, economical, and aesthetically pleasing.

Objectives

- ◆ To identify which flowering plants are favored by green lacewing, a generalist predator, and a parasitoid specialist *Lathrolestes nigracollis*.
- ◆ To evaluate the effect of incorporating these flowering plants into landscapes on beneficial insect herbivores population dynamics.
- ◆ To produce educational tools, interpretive landscape displays, slide series, and a fact sheet to educate practitioners and educators on the concepts and benefits of incorporating certain flowering plants into landscapes.

Findings and Accomplishments

Field emergence of the wasp was observed by the use of field and laboratory emergence cages. Soil samples were cut to fit into a plastic flat; once in the laboratory, flats were enclosed in dark trash bags, the open ends of which were sealed in a canning jar. The jar with the attached bag was suspended with a dowel. In all, 48 flats were maintained in the laboratory for first-generation emergence of birch leaf miner and the wasp. On average *L. nigracollis* lived longer when provided with a floral food source *Euphorbia polychroma* (cushion spurge). This was because the floral structure (nectaries) of the plant was available to the insect. Average total parasitism was also greater in treatments with flowers.

An evaluation of incorporating flowers into the landscape was done by planting shasta daisy plugs (Little Princess *Chrysanthemum maximum* and Marconi *Leucanthemum superbum*) and coriander (*Coriander sativum*). These plants, one species on each side, encircled three Delaware Valley White azaleas (*Rhododendron mucronatum*). In all, four treatments were used to clarify the role of flowering plants in reducing the numbers of the azalea bug, *Stephanitis pyroides*, a known pest of the susceptible cultivar. The treatments with flowers and without flowers were replicated 22 times. A split-plot arrangement among those treatments included the release of larval green lacewings, *Chrysoperla rufilabris*, in 11 plots.

The plants were inoculated with 20 lacebug nymphs on each azalea in each plot in mid-June. Green lacewing larvae were placed, five per plant, on the predator-added split plot, with and without flowers, three times at equal intervals beginning in June. Weekly data was collected on azalea, daisy, and coriander flowering. Biweekly data was collected on azalea lacebug and green lacewing from all plots. These data are still being summarized.

Although we have not yet documented an impact by the lacewing larvae, the presence of flowering plants reduced lacebug numbers because of the buildup of predators such as syrphid, lady beetles and other unidentified predators. There appears to be a seasonal impact of

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Collaborators

University of Rhode Island
The Brickman Group, Ltd.
Rhode Island Nurserymen's Association
New Jersey Department of Agriculture
Garden State Parkway Authority
Cornflower Farms
Ricon-Vitova Insectaries

SARE Grant

\$80,344

Match

\$16,586

Duration

1997 to 1999

Project Number

LNE97-95



Project Number

LNE97-95

flower species on the duration of predator species and abundance. Coriander flowered earlier but more briefly than the two daisy species, and appeared to harbor less diversity than the daisy. However, there were more species of syrphids in the coriander. The azaleas were small, and we believe that many released lacewings left the plots. The flowers and azaleas established well, so prospects for clear results are high in 1999.

The investigators met in early 1999 to discuss developing the educational component of the project. The participants have full capacity for producing high-quality video and stills for the educational materials, as well a substantial field experience with both pests. This experience will support the educational component.

Potential Contributions and Practical Applications

There have been entreaties by production nurserymen, regulators, and the public for reliable alternatives to reducing pest numbers in the production and landscape setting. The results from this study will yield specific information on types of flowers that support specific natural enemies at particular times of the year. The practical application is that growers can plan on having a certain beneficial insect species diversity at a specific time of year.

Farmer Adoption and Direct Impact

Producers who have become aware of this project have commented on enhanced commercial prospects for marketing perennial plants that attract

natural enemies and may put that information in their catalogues.

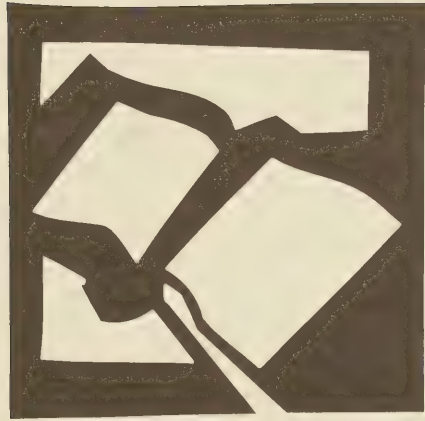
Areas for Additional Study

This study falls in the area commonly called conservation biological control. This form of biological control has attracted interest in recent years in conventional cropping systems. However, while the enthusiasm in the public sector is there, there is a paucity of scientific observation on the interaction of flowering plant species and beneficials in a predictable way. Specifically, there is little specific information on how to predict which natural enemy will be attracted, at what time of year, and to which plant species. We have strong preliminary data that show floral architecture plays a strong role in determining the success of a species foraging for nectar and pollen.

Dissemination of Findings

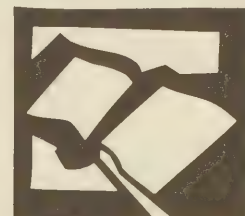
Rhode Island and New Jersey nurseryman and landscapers will have our research results presented to them at workshops addressing the concept of incorporating flowering plants in their IPM programs. We will also post life history videos of leaf miner, azalea lace bug, green lacewing, and other predators on the World Wide Web for ready access by the lay community. By the end of the project, landscape displays will be established on Rhode Island and New Jersey campus horticultural farms for demonstration.

Reported December 1998



professional development

Farmer-to-Farmer Learning Groups: Curriculum for Establishment & Facilitation



Summary

This project involved the development of an educational guidebook for establishing and facilitating farmer-to-farmer learning groups. The guide draws on the practical experience of farmers, Cooperative Extension agents, and agriservice personnel.

Objectives

- ◆ Encourage the establishment of farmer-to-farmer learning groups that enhance sustainable agriculture.
- ◆ Survey existing farmer-to-farmer learning group participants and facilitators to determine effective methods for developing and facilitating these groups.
- ◆ Develop and adapt educational material in the form of a guidebook for the implementation of farmer-to-farmer learning groups. These materials would emphasize practical examples and case studies that illustrate three components—recommendations for establishing groups, educational methods for facilitating them, and educational tools for achieving group learning goals.
- ◆ Publish, market, and distribute the developed guidebook to extension educators, farmers, and agriservice organizations in the Northeast.

Overview

Farmers cite other farmers as a major source of information when making decisions about their farm businesses. Facilitating such farmer-to-farmer learning and transfer of information can be accomplished through developing learning groups.

Cornell Cooperative Extension of Cayuga County has successfully implemented learning groups over the last six years. These groups have focused on bringing farmers together to share experiences, exchange information, and seek out ideas. The concept has generated interest among other extension educators, farmers, and agriservice businesses and organizations.

This project involved the development of an educational guidebook for establishing and facilitating learning groups. Farmers and agriservice people who are involved in learning groups were identified and a survey was developed to obtain pertinent information on how effective learning groups are established and facilitated. In addition, individual interviews were done to gather more in-depth information.

The guidebook draws on the practical experience of farmers, extension agents, and agriservice people. Group dynamics, adult learning, facilitation skills, and educational activities are provided.

Key Results

A guidebook has been developed which provides recommendations and methods for establishing farmer-to-farmer learning groups. The guidebook is being marketed through extension, agriservice, agricultural publications, and electronic lists and bulletin boards.

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Collaborators

Cornell Cooperative Extension
Cayuga County Natural Resources
Conservation Service
Fessenden Farm

SARE Grant

\$24,095

Match

\$7,614

Duration

1996 to 1998

Project number

ENE96-15



Methods and Findings

Existing farmer-to-farmer learning group participants and facilitators were identified through a review of literature, electronic bulletin boards and lists, agricultural publications, and word of mouth. A survey was developed to determine how groups were established, what the benefits and effectiveness of the groups were, how the groups were facilitated, and what activities had been useful. Positive and negative experiences were solicited.

A guidebook has been developed drawing on the survey and interview results. Up until now, informa-

tion on how to establish and facilitate groups has been by word of mouth or has been extrapolated from the general study of group work and group dynamics. The guidebook provides recommendations and methods for establishing groups, educational methods for facilitating them, and education tools for achieving group learning goals.

The guidebook is being marketed through extension, agriservices, agricultural publications, and electronic lists and bulletin boards. Over 200 guidebooks have been distributed in this way.

Reported December 1998



A Diagnostic Team Approach to Enhancing Dairy Farm Sustainability

Summary

The goal of this two-year project was to implement a Minnesota model for using diagnostic teams on dairy farms. The teams initially focused on two key areas—reducing the incidence of mastitis and increasing income over feed costs. Another goal was to introduce off-farm team members to information about using diagnostic teams successfully with project farms, and this new information would allow them to use this team model with a larger number of farm families.

Objectives

- ◆ To implement a model for forming diagnostic teams for farm-level problem solving of critical issues.
- ◆ To improve team member skills in problem solving, critical thinking, and whole-farm planning.
- ◆ To use farm-oriented diagnostic teams on participating dairy farms.
- ◆ To evaluate the impact of the diagnostic teams and revise training manuals.
- ◆ To disseminate information about the effectiveness of diagnostic teams through field days, pasture walks, and educational conferences.
- ◆ To assist team members in forming new teams and expanding their focus areas.

Key Findings

The model for forming on-farm teams has been implemented and modified. Currently, seven of the fourteen year-one teams and thirteen of the fifteen year-two teams continue to meet on a regular basis. Additionally, team members have formed new teams with other farm families that did not participate in the project. Training materials for using on-farm advisory teams have been revised, based on team member feedback.

Preliminary results have shown improvements in on-farm feeding management, in milk quality, and in milk yield. Farmers indicated that the teams had a role in helping to make timely changes in critical items of the farm business for short-term gains, and also that teams provided a focus for long-term, strategic discussions.

Not all of the teams were successful in achieving their goals, nor did all the teams continue to work for the entire project year. Two keys for maintaining successful teams were the presence of an off-farm coordinator and the team having a compelling reason to meet, often around some critical issue or change on the farm.

Farmer evaluations indicate that the teams were valuable and that better communication and more timely decision making has a positive impact on farm business. Preliminary information about the use of advisory teams has been presented at international, national, and regional meetings for educators and dairy producers.

Reported December 1998

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Larry Hutchinson
Farm field personnel
Pennsylvania dairy farm families
Pennsylvania State University

SARE Grant

\$34,650

Match

\$40,866

Duration

1996 to 1999

Project Number

ENE96-16





Development of Dairy Farm Discussion Groups in Vermont & New Hampshire

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Collaborators

University of New Hampshire
Cooperative Extension
University of Vermont Cooperative
Extension

SARE Grant

\$22,300

Match

\$20,400

Duration

1997 to 1999

Project Number

ENE96-18

Summary

This project's goal has been to develop dairy farmer discussion groups in Vermont and New Hampshire, and project results have far exceeded the initial expectations of the planners. The New Zealand dairy discussion group method was learned by the original four collaborators, who then conducted training sessions for interested Cooperative Extension personnel. From these beginnings, the discussion group model has gained wide acceptance and acclaim as an efficient and effective conduit of information and knowledge to dairy producers. In Vermont, at least eight dairy farmer discussion groups are currently active. These discussion groups are linked to 130 to 150 dairy farms, and represent on the order of more than 50,000 dairy animals. The format and content of monthly meetings range from open discussions on production practices or the latest facility designs to member-selected topics presented by outside speakers. The subjects include stress management, personnel management, lameness, calf raising, nutrition, teat skin evaluations, bunk management, extended calving intervals, personality evaluations with employers and employees, mastitis control, farm safety, waste management, and large-farm permit requirements. The discussion group model will continue to be successful because the group determines the subject matter; the facilitator's job is to secure information on specific topics and to obtain resources to support the discussion group.

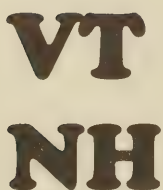
Objectives

- ◆ Train two sustainable agriculture agents, one from UVM and one from UNH, in the group method of dairy farmer education.
- ◆ Train one Vermont and one New Hampshire farmer in this method of dairy farmer education.
- ◆ Develop five farm management groups in Vermont and New Hampshire.
- ◆ Provide three training meetings for facilitators in five locations on farm communication skills, increasing community support of agriculture, and whole-farm planning.

Specific Project Results

Project personnel spent 30 days in New Zealand observing 11 Livestock Advisory Consulting Officers (COs) conduct 18 dairy farmer discussion groups (DGs). These COs had up to 15 years of experience leading DGs. They employed a variety of techniques in facilitating groups and encouraging farmer interaction. New Zealand farmers attending DGs were interviewed about the benefits of the groups, their important functions, markers and elements of success, and why farmers did or did not attend on a regular basis. More meetings were held with management-level employees of Livestock Improvement Corporation to explore job expectations, professional improvement needs, and administrative requirements of COs. Then, in February of 1997, 30 farmers, extension personnel, and agribusiness representatives participated in a training session on DGs. The day was an enormous success and led to widespread understanding of the DG method.

A farm data sheet developed by Jean Conklin has been well received by DGs. The sheet has been



widely distributed and is extremely useful in keeping groups focused and on track.

An article on DGs written by Louise Calderwood appeared in the April 17, 1997 edition of *Hoard's Dairyman*. Mention was made of the article on the Internet list Dairy-L and resulted in over 40 requests for reprints from across the United States as well as Canada, Brazil and New Zealand. Surveys were mailed with the reprints and returned surveys indicated the information received would be put to use immediately in farmer education programs.

Louise Calderwood and Jean Conklin presented a poster on DGs at the 1997 meeting of the National Association of County Agriculture Agents, and Louise Calderwood submitted an abstract to the Northeastern Regional Meeting of the American Dairy Science Association in the summer of 1998. Rick LeVitre made the presentation at ADSA.

During the spring of 1998, five presentations were made to over 100 farmers outlining the value of DGs. As a result, a DG was started in the White River Junction area and attendance increased at the Newport area DG. Louise visited two established DGs to demonstrate the New Zealand style of group facilitation.

Vernon Hurd of Newport Center, Vermont and David Keith of Haverhill, New Hampshire were the two dairy farmers who participated in initiation of the discussion group project. They accompanied the extension agents on the New Zealand trip and observed the COs, providing a farmer's perspective. David and Keith also interviewed their New Zealand counterparts to increase their understanding of DG facilitation. Additionally, they played integral parts in developing and presenting the February 3, 1997 training in DGs. Vernon Hurd currently serves as a farmer-convener of the Newport area DG and has been very helpful in providing feedback on facilitation techniques.

Now, at least eight dairy farmer DGs are currently functioning. Colleen Helenek of the UVM extension facilitates two DGs; one is in the Newport-St. Albans area and includes mostly large farms. Glenn Rogers, also with UVM extension, assists with this group. Colleen is also a facilitator for Addison County. The Addison county DGs are primarily larger herds (150 to 750), and one group is composed of the employees of these larger dairy operations.

Outside speakers were used to lead discussions in the spring of 1997 on farm-family communications. Presentations were also made on the DG technique and how it could benefit them. Karen Schneider of the UVM extension conducted meetings with different DGs on stress management—this has been a high-priority issue for many groups. Phil Benedict and other Vermont Department of Agriculture personnel have met with different DGs to discuss farm relations with nonfarm neighbors and requirements for large farms permits.

Potential Contributions and Practical Applications

This project has exceeded all expectations. Knowledge has been disseminated via the Internet, professional conferences, the popular press, and hands-on demonstrations; eight new, active DGs have been formed as a result of information gained in New Zealand. Thirty people have attended workshops, 130 have attended conferences, and 43 have participated in Internet demonstrations.

Without exception, the comments from participants have been positive. The discussion group model should be encouraged and further disseminated.

Reported December 1998

Project Number

ENE96-18



Regionally Based Professional Development Program for Grazing Systems Management

Coordinator

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Collaborators

Pennsylvania State University
University of Maryland
USDA-NRCS in Pennsylvania &
Maryland

SARE Grant

\$92,149

Match

\$12,576

Duration

1997 to 1999

Project Number

ENE96-21

Summary

This project combined the efforts of research scientists, extension workers and NRCS personnel in Pennsylvania and Maryland to develop an educational curriculum in management-intensive grazing. The four educational curriculum units developed were pasture management, plant and animal management, grazing management, and economics and environment. Four train-the-trainer workshops were held for extension educators and conservation specialists. Seventy-five extension educators, NRCS personnel, and conservation specialists attended.

Objective

- ◆ To develop a curriculum and train extension, conservation, and related agribusiness personnel through regional workshops to transfer information about economically sound and environmentally sensitive integrated-grazing systems.

Results and Impacts

Personnel from two universities—Pennsylvania State and the University of Maryland—and NRCS personnel in Pennsylvania and Maryland contributed to the development of this educational curriculum in management-intensive grazing. Four different units were developed—pasture management, plant and animal interface, grazing management, and economics and environment. Each unit contained about 200 pages divided into 10 chapters including technical information, teaching notes, and copies of additional resource material. The goal was to develop a format that is usable by educators in a train-the-trainer approach.

The initial draft of the curriculum was completed, evaluated, and revised in late 1997. Two different two-day educational workshops were conducted in Danville, Pennsylvania and Port Deposit, Maryland in late 1997, and in April 1998 in Clarion and Somerset, Pennsylvania. These programs attracted 75 extension educators, NRCS personnel, and conservation specialists from six states. All workshops were evaluated, and the results of the evaluations are being used to improve the four different curriculums with the goal of having a professional development program that can be effectively used to educate producers and agricultural professionals. These four units are undergoing revision and will be available in 1999. There is considerable interest in obtaining copies of these curriculums. Several educators have used portions of these curricula in educational programs for producers during 1998. The potential impacts and initial feedback from producers should occur during 1999.

In addition to the major objectives of this program, these educational curricula were modified and adapted for use in two NRCS training workshops held in State College, Pennsylvania during 1997 and 1998. These workshops were four days long and were attended by sixty NRCS personnel from fourteen different states.

Reported January 1999





Video Training on Improving Water Quality Featuring Farmers & Their Practices in the German Branch Watershed

Summary

The German Branch Watershed, located on the Eastern Shore of Maryland, is one of the largest sub-watersheds of the Tuckahoe Creek. The Tuckahoe flows into the Choptank River, which subsequently meets the Chesapeake Bay. In November of 1990, the USDA announced the selection of the German Branch for the USDA Water Quality Program. The goal was to provide farmers and ranchers with the educational, technical, and financial means to respond to on-farm and environmental concerns and related water quality issues. Ninety-two percent of operators within the watershed have participated in the project.

The video has two goals—to illustrate that community-wide participation is necessary for successful projects, and to show best management practices. The completed video is 36 minutes long. In it, six farmers talk about best management practices that improve water quality—integrated pest management, nutrient management, pre-sidedress nitrogen test, cover crops, minimum tillage, manure management, dead broiler composting, bay-wise landscaping, and fish ladders. In addition, a homeowner in the watershed talks about changes in his landscaping practices, a district manager for the Queen Anne's County Soil Conservation District shares his agency's contributions, and a fertilizer company representative and crop consultant talk about their participation. The county Cooperative Extension agent in Queen Anne's County and leader of the project narrates the video. Two farmers, five extension faculty, and two Farm Service Agency representatives help illustrate best management practices through non-speaking roles.

Objective

- ◆ To increase the understanding of extension agents and other agricultural professionals of both team approaches and watershed improvement issues. On the video, farmers talk about successful farming practices that enhance the environment and improve profitability.

Specific Project Results

The specific project result is the video itself, which is available for a modest fee for educational purposes. Feedback on this video was captured in December 1998, when we sponsored a dinner for participants and farmers in the watershed. About 60 people attended; the audience was very pleased with the results. They had many suggestions about who we should share the video with. These included the governor, tributary teams who are working to clean up Chesapeake Bay, the Farm Bureau, conservation districts, and Maryland Public Television. We are following up on those suggestions. The video will be also be shown during the "County Highlights Session" of the winter meeting for the Maryland Soil Conservation Districts.

Reported January 1999

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Collaborators

University of Maryland
Queen Anne County farmers

SARE Grant

\$24,351

Match

\$21,500

Duration

1996 to 1998

Project Number

ENE96-22

MD



Communication and Outreach for Sustainable Agriculture: A Video Training Program for Extension

Coordinator

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Collaborators

Musconetcong Watershed Implementation
Project

New Jersey Farm Bureau

New Jersey Resource Conservation and
Development

SARE Grant

\$49,998

Match

\$12,090

Duration

1997 to 1998

Project number

ENE96-23

Summary

The goal of this project was to create a training program for Cooperative Extension personnel that would focus on the human dimension of sustainable agriculture by highlighting the successful communication and collaboration efforts that led to the success of the Musconetcong Watershed Implementation Project.

Objectives

- ◆ Increase extension personnels' overall knowledge and understanding of the importance of communication.
- ◆ Improve and refine communication and consensus-building skills.
- ◆ Increase awareness of the value of communication in encouraging farmers to adopt sustainable practices.
- ◆ Motivate extension personnel, through a positive example, to embark on collaborative projects.

Project Narrative

Typically, in a research project of any kind, the Center for Environmental Communication (CEC) creates an informal advisory group to guide us during a project by reviewing draft materials, providing advice and feedback, and suggesting relevant contacts or references. In this project, we also added people to the group who could review a rough cut of the video and provide feedback both on content and technical issues and those who could advise and assist us with dissemination of the final video.

Our advisors played a key role in this project. Although the CEC had previously made a well-received video on the communication of risks at a hazardous waste site, our research into the communication of agricultural issues was relatively new. As a result, we relied heavily on the feedback from our advisors in extension and NRCS to help us focus the content and engage the intended audience. For example, at an early meeting with an extension agent and NRCS personnel involved with the Musconetcong project, we discovered that the idea of using didactic graphics to "teach" communication would likely be viewed as condescending by many agents and specialists who felt they already were engaged in this type of activity. That feedback was invaluable for the subsequent creation of a script that would highlight the communication and collaborative techniques used in the project while "telling the Musconetcong story."

Our technical advisor from Rutgers' Office of Television and Radio was invaluable in helping us translate our vision into video. Often, when people decide they want to make a video, they are convinced that their technical knowledge of a topic will adapt naturally and easily into a compelling video. In fact, the medium has its own constraints and idiosyncracies, and simply having great information—or even a great story—does not guarantee a good video. At the outset, our technical advisor pushed us to answer key questions before we even sat down to write an outline for the video: *What is the key message of the video? What do you want people to think, feel, and do after they've seen it? What are the key points you need to make to get people to that place? What visual information do you need to gather to illustrate those*

points? This up-front thinking saves a great deal of time and money in the long run; filming without answering these questions can lead to hours and hours of unused, unnecessary footage.

Also on our committee was the director of Cook College's Office of Continuing Professional Education, who offered with a dual perspective: he is both a leader in delivering short courses to a wide variety of audiences and a farmer. He was able to provide us with information about continuing education courses into which the video might be integrated.

Musconetcong farmers also provided important feedback throughout the process. In interviews, careful attention was paid to farmers' reactions to questions, whether they understood what we were asking, and whether they felt the questions were relevant. This helped enormously in subsequent on-tape interviews of farmers.

Before creating an outline, we conducted preliminary interviews with several partners in the Musconetcong project to find out general background on the development and progress of the Musconetcong project and the lessons to be learned from it. We also found out who to talk to and which communications aspects could be highlighted on videotape. After getting a sense of the main themes, we created an outline for the video, which we circulated among our advisors for comment. After revising the outline, we were then ready to develop a video treatment and a script, which was the most complicated, intensive, and critical part of the project. *A common mistake fledgling video producers make is to go out and film with an idea but no written treatment.* We learned this lesson from our first effort and from others' stories about their forays into video making.

We hired a professional producer to help us develop a treatment. It was useful to work with someone who could provide vision and feedback; we recommend it for those who are producing their first video. After that treatment was circulated for comments and revised, we then went on to create a script based on the treatment. The filming and the script development took place concurrently—for us, each process informed the other. Several revisions of the script occurred as a result of ongoing feedback, the necessity to cut back the length of the video, and the collection of new footage that in some instances illustrated our points better than earlier footage. As executive producers on this

project, we made final decisions on the content.

The goal of the filming was to capture unstaged interactions among project participants that would illustrate the concepts of communication and collaboration and to record participants' views about the project in their own words. We worked closely with participants in the Musconetcong program to identify farmers whose participation would illustrate the concepts we were trying to convey, and to identify meetings among the various partners in the project that would illustrate collaboration. Participants also alerted us to interactions that would provide opportunities for filming, such as agency representatives sitting down with a farm family and talking about nutrient recommendations. They also provided access by explaining our project to others and obtaining their permission to be filmed.

We cannot stress enough the importance to this project of the working relationship between CEC and the project participants. Without their help and enthusiasm, we would not have had access to and cooperation from the farmers, agricultural businesses, and other people we wanted to highlight in the video. We were careful to talk to people ahead of time and answer any questions they had about the video; we also included everyone who was filmed in the early screenings of the video so they would have a chance to see themselves and be comfortable with how they were depicted. Only one person asked for a change, and we had already independently decided to edit that person's interview.

Editing the video is almost always time consuming, and often is where projects of this type can get bogged down. Regardless of how efficiently you shoot, there is still a lot of footage to go through, and there are no short cuts around the tedium of going through the footage to write down numbers for useable clips. Once again, without a script, this is an almost impossible task; it is like trying to navigate through unknown waters without a chart. A good script defines the task and makes it as painless as it can be. The rough cut, which had all the final elements but not much polish, took a week. We narrated the voice-over (for final copy we used professional talent) and put the clips together with no dissolves or graphics. This is the version

Project number

ENE96-23

we used for our first round of pilot screenings. After we received feedback from a variety of audiences, we did another rough cut. We piloted that twice, and did another cut based on that feedback. The second and third rough cuts were progressively less intensive; by the final, we were tinkering with voice-over phrasing and length. The final step was to take the video into the studio for on-line editing, professional voice-over, and the addition of graphics, credits, and music.

In all, we held five pilot workshops, and each pilot differed in audience, comments asked for and given, and the discussion about communication issues. With each new video version, the discussion focused less on the videotape itself and more on the issues of communication, what other audiences might want or need to see the video and in what venues, and what materials were appropriate to include with the training packet.

Dissemination strategy

We received contact names, venues, and commitments from attendees to show the video in their work. As an example, all agreed that watershed stakeholders would be an appropriate audience for the video, as it illustrates a relatively new concept—collaboration—in environmental management. The NJDEP watershed manager in attendance asked us to bring the video to a meeting and allotted 40 minutes for the showing and discussion in the meeting agenda. Similarly, continuing education representatives suggested courses into which the video might be integrated. Also, there was discussion about how the Kellogg project might fund an adaptation of the materials to make the video appropriate for a college course. In all, we were excited about the range of possibilities people saw for the video, which included presentation to extension, FFA, 4-H, the Cranberry Institute, municipalities, commodity groups, suppliers, Farm-A-Syst and Home-A-Syst programs, other Kellogg-sponsored projects, homeowners, legislators, and others.

We will pursue a tiered dissemination strategy to integrate the video into a few key areas that focus on our target audience—continuing education courses, showings at conferences and meetings, and networking with extension people—and we will produce a brochure that advertises the video and send that out to a larger mailing list. In the future, we will continue to do outreach to wider audiences.

The group was clear—as others have been—that materials, to be most useful, should be kept short and sweet. There was consensus that long case studies or long explanations would not be useful, and that as a trigger for discussion it would stand on its own and need little accompanying materials. We did develop some collateral, including quotes of support from environmental groups, an overall background of the Musconetcong project, an overview of lessons learned from it, pitfalls, discussion questions, an epilogue, a glossary, and definitions of sustainable agriculture.

Lessons Learned

Know your audience and its needs. Ask your audience what would be the most useful product for them. Often they can tell you more about what they *don't* want than they do.

Get feedback and then listen to it. Don't be afraid to change gears if you think it will give you a more useful product. In our case, we found that our vision of a "training module," used successfully for another audience, was simply not appropriate for our extension audience.

Get a professional producer to help you if you have no experience. Translating your idea into video is the job of professionals.

Don't film without a treatment. You will waste time and money if you begin shooting video without a clear, written idea of where you're going.

Make and preview rough cuts of the video and ask for written evaluations and open-ended discussion. It is amazing what others pick up that you can't see because you are too close to the subject material.

Don't be afraid to make final decisions—it has to be finalized sometime. You have the original idea of what you wanted to portray and you are the executive producer of the video. Make sure changes reflect audience concerns, but don't dilute your original vision and goal. It is a fine line, but you won't make a video that pleases everyone.

Understand that your subjects for the video are likely to be your best avenues for dissemination. Making this video was a process that began when we were garnering support for the proposal. We worked hard to keep most of these people on board throughout the process, and are involved now in working with these same people to distribute the video.

The video can't be all things to all people.

While many have suggested to us that the video can be used on a wider audience than the extension audience we had intended, we also see that its impact may be diluted on non-farm audiences, or that explanations must be given to explain aspects of the video that are obvious to its intended audience.

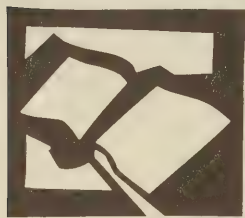
We are currently making copies of the video.

When the supporting materials are finalized, we will price the video according to how much it will cost us to reproduce and send. As with all CEC materials, consideration will be given to nonprofit groups whose budgets are modest, a strategy that has allowed us to disseminate our research inexpensively but not at a deficit to our nonprofit.

Reported December 1998

Project number

ENE96-23



Community-Based, Sustainable Agricultural Development: Developing Cooperatives & Adding Value

Coordinator

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Collaborators

Cornell University
Pennsylvania Association for
Sustainable Agriculture
Pennsylvania State University
University of Vermont

SARE Grant

\$56,090

Match

\$24,110

Duration

1996 to 1999

Project number

ENE96-25

Summary

The Adding Value for Sustainability project was developed by the Pennsylvania Association for Sustainable Agriculture (PASA) to help Cooperative Extension agents and other agricultural professionals better assist small-scale, value-added processing enterprises.

Objectives

- ◆ Introduce extension and other USDA personnel to concepts of value-added enterprises.
- ◆ Increase the understanding of extension staff of both long and short-term benefits to farmers and communities from value-added enterprises.
- ◆ Increase the knowledge base of extension staff regarding value-added business start-up and implementation strategies.
- ◆ Help extension staff identify innovative producers and develop networking strategies among those that are well-suited to use these marketing strategies.
- ◆ Facilitate dissemination of new and innovative marketing information to state and county clientele through newly developed publications and videos.

Methods and Results

The Adding Value for Sustainability project helped fill a need for more information on small-scale processing enterprises, a marketing alternative that the targeted audience sees enormous interest in from their clients. Evaluations, conversations, and newly developed and existing projects indicate that the Adding Value for Sustainability project helped extension agents and other agricultural professionals better serve their clients.

PASA completed two professional development programs, and an 82-page guidebook, *Adding Value for Sustainability*. As stated in the guidebook, value adding offers farmers the potential to recapture a larger share of the food dollar—according to the U.S. Department of Commerce, the farmer's share in 1913 was 46%, while in 1997 it was down to 24%. By processing their own raw agricultural products into higher-value, consumer-ready products, farmers have the opportunity to retain income.

Small-scale processing offers farmers a financially viable alternative to competing in conventional, large-scale marketing channels. Keeping to a small and medium scale, sustainable farmers in business assure better protection of the environment and vital rural communities. The training programs and guidebook are encountering strong interest from producers across the Northeast. Frustrations with extension's lack of knowledge on sustainable agriculture and alternative marketing channels is echoed by many producers who appreciate the efforts aimed at providing more information.

As a result of this project, two professional development programs and a guidebook on small-scale processing enterprise development for extension agents and other agricultural professionals were designed and completed. Also as a result, extension agents and other agricultural professionals indicated they are much better equipped to assist clients due to their increased knowledge of the marketing, financing, food safety, and community support strategies available to small-scale processors.

The training programs and the guidebook have inspired the creation of new and the enhancement of existing programs that support small-scale processing enterprise development. Extension agents and other agricultural professionals indicate more confidence in their ability to conduct programming because of a fuller knowledge base to assist producers and others in problem-solving, experimentation, and



development of small-scale processing enterprises.

The programs and guidebook introduced extension agents to several successful processors.

Through their stories, extension agents and others have indicated more clarity in identifying prospective producers who have the management skills to benefit from the increased profitability that value-added products can bring to a farm operation.

Through PASA's partnership with Cornell University's Farming Alternatives Program, community-based strategies for supporting small-scale processors through networks, regional product identity projects, food processing incubators, new generation cooperatives, and educational programs were explained in detail. The Farming Alternatives Program provided an excellent resource for educating extension and others.

The guidebook includes suggestions on how to develop educational programs for producers in order to effectively disseminate this information and how to assist producers in planning and implementation.

PASA worked in collaboration with Cornell University in the development of the first program and the guidebook. An advisory committee of 22 Cooperative Extension agents, other agricultural professionals, and producers throughout the northeastern United States guided the project.

Reported December 1998

Project number

ENE96-25



Cooperating for Sustainability: A Training Program on Cooperatives for USDA Personnel in the Northeast

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Cornell University
Agway, Inc.
CoBank
Cooperative Development Institute
Jane Livingston
PASA
Pennsylvania Council of Cooperatives
Rutgers Cooperative Extension
Tuscarora Organic Growers

SARE Grant

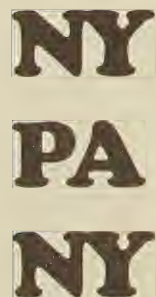
\$56,090

Match

\$24,110

Project Number

ENE96-25a



Summary

This project delivered a regional satellite teleconference to more than 30 down-link sites in 12 northeast states, as well as Arkansas, Illinois, and Missouri. About 260 USDA, Cooperative Extension, and other agricultural professionals attended. A comprehensive guide book was developed for participants in the program. This project preceded and is linked to ENE96-25.

Objectives

- ◆ To increase the understanding of USDA staff in the region about the current trends in agricultural cooperative enterprise.
- ◆ To build capacity among USDA personnel in the Northeast to better assist new and emerging agricultural cooperatives trying to achieve more sustainable agricultural practices.
- ◆ To enhance the performance of new and emerging cooperatives by disseminating information on cooperative development by building new regional partnerships among USDA entities, farmers, existing cooperatives, and private organizations interested in cooperative development.

Methods

The project addressed an educational need among educators, advisors, and economic development professionals for up-to-date information on cooperative enterprises. New cooperatives are being formed to add value and to market products, cut farm operating expenses, as well as adopt sustainable farming practices. There is a lively interest in how to increase the probability of success for cooperatives serving producers in the Northeast.

The project involved conducting an educational needs assessment, developing resource material, planning a conference, and conference delivery. An advisory committee made up of USDA, extension, and organizations like PASA and the Center for Sustainable Agriculture worked to develop and deliver the teleconference. It was held on April 2, 1997.

At the core of the presentation were three case studies that had been developed to illustrate the development of agricultural cooperatives. The studies were from the Western New York Crop Management Cooperative in Perry, New York, the Hudson Valley Growers Cooperative in Kingston, New York, and the Coastal Growers Cooperative in Westport, Massachusetts. The conference addressed the role of cooperatives in sustainable agriculture, the skills needed to advise new and emerging cooperatives, the establishment of development teams, financing, and a look at why cooperatives succeed or fail.

The teleconference offered interviews, discussions, and question-and-answer sessions. Segments shot on location allowed participants to hear frank discussions of both success and failure, with an eye toward sharing the lessons to be learned. During question-and-answer segments following each on-location segment, participants could direct their questions to representatives from each organization.

Results

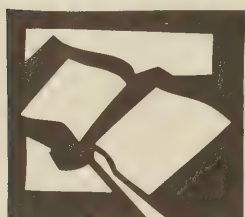
A video was produced of the teleconference, offering the proceedings in an edited form, and the 100-page guide book developed for participants is in use as a general reference and educational tool. About 260 USDA and other professionals attended

the conference; after the teleconference, this SARE project then entered a second phase, which is described under ENE96-25 "Community-Based, Sustainable Agricultural Development: Developing Cooperatives and Adding Value."

Reported February 1999

Project Number

ENE96-25a



Management & Evaluation of Soil Health

Coordinator

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Collaborators

Rodale Institute
Pennsylvania State University
Rutgers University
Cornell University
USDA-ARS
University of Maryland

SARE Grant

\$60,000

Duration

1997 to 1999

Project Number

ENE96-26

Summary

The goal of this project is to offer Cooperative Extension agents and others current and practical knowledge of soil health, and especially knowledge of the connections among organic matter, biological activity, and chemical and physical soil properties.

Inservice training workshops and educational program packages are the primary tools for achieving this goal. An advisory committee of extension agents and specialists from around the region is guiding the content and the format of the training.

Objectives

- ◆ Provide in-service training on soil quality management and assessment to 50 to 60 extension agents from the mid-Atlantic region.
- ◆ Develop and distribute two packaged education programs for extension staff to use in their own local education programs.

Abstract

The first objective listed above was completed on schedule when 59 agents or specialists attended two workshops held August of 1997 and July of 1998. In 1998, a major change was made to the workshop when a decision was made to increase the amount of time spent in small groups engaged in hands-on activities. Also, the evening session with farmers that was supposed to focus on strategies for educating farmers on soil health was replaced with a discussion of soil myths. Also added was a panel discussion by agents with practical experience in educating farmers about soil health; this was offered as the final session in the workshop.

Evaluations indicated that changes made to the format were improvements. The score given to the overall workshop rose from 7.4 (on a scale of 0 to 10) to 8.8. The range of scores for individual presentations went up as well. In 1997 they ranged from 3.12 to 4.78, and in 1998 the range was from 4.0 to 4.9.

The second objective, developing and distributing two packaged programs for extension staff to use in their own local education programs, is far behind schedule. The first package, an overview slide show, was due to be distributed in October of 1997; it was completed in October and reproduction is now underway. It has been sent to Doug Beegle, who will reproduce the show, which includes notes, handouts, resources, and a pretest, this winter. I suggest that Doug put a message out on the soil quality listserve, which has everyone that attended either workshop on it (there may be a few others also on it, but that should not be a problem) asking who would like to receive a copy of the slide show. He will then get the slides duplicated and sent out. Northeast SARE Coordinator Fred Magdoff also offered to mount the slideshow on the SARE website, so a copy of the Powerpoint presentation has been sent to him on a Zip drive.

The second package, a more in-depth workshop on soil health, is currently being compiled and written. The ingredients for this package should include directions for successfully using the participatory activities we developed for the workshop. These participatory techniques include the qualitative sensory evaluation using soil health cards in the field, the quantitative evaluation of soil indicators using components of a soil health test kit, the sensory evaluation of soil pairs collected from fields with known management history, and instructions for setting up and presenting various soil health demonstrations.

Reported December 1998

PA
NJ
NY
MD



Developing & Publishing Sustainable Farming Resources for Agricultural Extension Professionals & Field Crop Producers

Summary

This project is creating a series of lesson plans targeting key integrated crop management (ICM) and integrated pest management (IPM) issues. It has also developed a grower-oriented field guide for corn.

Objectives

- ◆ Create a multistate advisory group of Cooperative Extension personnel and growers to facilitate the development of 24 educational modules and the revision of a crop management pocket guide.
- ◆ Develop and produce eight education modules in first year and sixteen more in the second in an effort to empower individuals to adopt sustainable farming practices at the local level.
- ◆ Teach extension professionals to use these new educational modules; record and evaluate clientele use of them.
- ◆ Within six months of funding, develop an improved, regional version of the publication *Your Pocket Guide to Alfalfa and Field Corn Management*, in concert with the educational subjects of the modules.

Results to Date

This project has Produced an improved, regional *IPM Field Corn Pocket Guid*, and has developed seven IPM-related lesson plans as templates for regional use by extension personnel.

Method and Results

The project's original intent was to use a regional advisory committee to direct development of two products—an updated version of the popular New York State pocket guide for alfalfa and field corn production, *Your Pocket Guide to Alfalfa and Field Corn Management*, and a series of lesson plans for use by extension professionals and other educators in training field crops producers to use sustainable management practices. With significant adjustment to the original plan, we have made clear progress toward promoting sustainable practices on farms around the region.

One of the advisory committee's first decisions was to limit the new pocket guide to sustainable practices for field corn production. Size and cost constraints are important considerations in producing a resource that will actually be used in the field. The committee chose to address one crop well rather than inadequately cover two crops. Field corn was chosen because it is more widely grown in the Northeast and may offer the greater opportunity for improving sustainable practice.

The *IPM Field Corn Pocket Guide*, which is about 300 pages long, has been reviewed by extension agents, researchers and growers across the region, and is currently in press. The print run is 4,000, and copies will be marketed and distributed in cooperation with the Natural Resources, Agriculture, and Engineering Service (NRAES). Cost per copy will be \$7 retail, or \$3.85 to extension and other land grant offices.

The potential audience for the pocket guide is the approximately 40,000 field corn producers

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Collaborators

New York State IPM Program, Cornell
Cooperative Extension
NRCS

SARE Grant

\$42,314

Match

\$9,742

Duration

1997 to 1999

Project number

ENE97-28



Project number

ENE97-28

in the Northeast. Equipped with this tool, they will more often properly identify, analyze, and address problems on the farm.

To date no lesson plan modules are complete, but will be in time for extension agent training in the early spring of 1999. The remainder will be completed by August 31, 1999. These training modules provide a curriculum for extension educators who are often too busy to develop their own lesson plans. They are designed to serve as a template for regional use. Local extension personnel may need

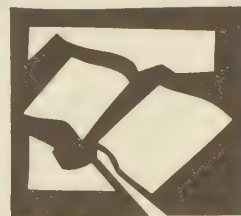
to supplement these plans with locally adapted extension educational or technical materials.

The initial modules are:

- Introduction to IPM and Tag (Tactical Agricultural) Teams
- Principles of Scientific Sampling
- Using Economic Thresholds
- Corn Hybrid Maturity Group Selection
- Optimal Seeding Rates for Field Corn
- Alfalfa Weevil Scouting
- Corn Rootworm Scouting

Reported December, 1998

University of Maine Cooperative Extension Compost School



Summary

This project will train Cooperative Extension, NRCS, FSA, conservation district, and state department of agriculture personnel from New England at the UMCE Compost School. The school will provide a thorough education about all phases of composting through classroom teaching, hands-on activities, and compost site visits. Currently, forty-nine individuals from the listed organizations have successfully completed the compost school program. These individuals have gained the necessary skills to work with the agricultural sector on composting projects and to advise individual farmers and growers on the benefits of composting and on establishing an on-farm composting operation.

Objectives:

- ◆ USDA, extension, and state department of agriculture personnel in New England will effectively address compost-related issues by acquiring the knowledge and skills for medium- and large-scale enterprises.
- ◆ Eighty trained USDA, extension and state department of agriculture personnel will assist farmers in New England in assessing the drawbacks and benefits of composting as a component of a whole-farm system.

Project Results

Forty-nine people from the designated agencies in New England have successfully completed the UMCE Compost School. In terms of distribution, Maine trained thirteen, Vermont trained nine, New Hampshire and Massachusetts eight, Connecticut seven, and Rhode Island four. UMCE Compost School sessions were offered in late 1997 and throughout 1998.

All of the participants funded from this project were able to pass the certification test at the completion of the compost school session each attended. The certification test measures the attainment of a certain level of competency in dealing with composting and compost facilities. Each participant was awarded a certificate.

The participant evaluations completed for each compost school session were extremely positive, with high marks given to the teaching faculty and the course content. Many good ideas were generated in the comments received from these participants. Improvements to the program and curriculum resulted from their comments. An example of a suggestion that worked well was the production of a laminated, pocket-size card with the formulas for recipe development calculations on both sides.

The participants were also vocal in expressing a need for additional training in composting beyond the basic course offered by the school. They identified three topics for advanced training: recipe development, troubleshooting compost piles, and marketing. An advanced training session was held from September 22 to 24, 1998, using these topics as the course material. This session was well attended.

Coordinator

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Collaborators

Maine Department of Environmental
Protection
Maine Department of Agriculture
University of Maine Agricultural and
Forestry Experiment Station

SARE Grant

\$101,560

Match

\$91,141

Duration

1997 to 1999

Project Number

ENE97-29

ME

Project Number

ENE97-29

**Potential Contributions
and Practical Applications**

An impact assessment was conducted in February of 1998 by telephone to gather information from the 1997 compost school participants regarding their activities since attending the compost school. There were five SARE-funded participants in this group. They reported working with a total of nine farmers to either correct problems with existing composting operations or to start up new ones. All reported that they were now more confident about working with and advising others on composting, and that they had gained the knowledge to do this from attending the UMCE Compost School. All were very appreciative of the opportunity to attend the compost school to obtain this level of training. Future impact assessments will be conducted to gather similar information from the other participants.

**Future Recommendations and Areas
Needing Additional Attention**

The participants covered under this project to attend the UMCE Compost School are from the New England states. There are many others in the same

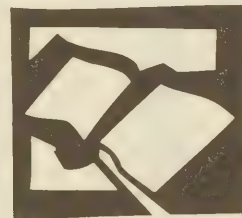
agencies in the Northeast, namely from New York, Pennsylvania, New Jersey, and Maryland, that could also benefit from the opportunity to attend this training program. In addition, the current focus on nutrient management plans for agriculture, particularly in Maine, will create a greater need for composting on farms and a greater demand for trained advisors to assist with these composting operations.

Publicity for the Activities and Programs

The UMCE Compost School has been fortunate to receive media attention for the various sessions of the school. The dedication ceremony for the school was keynoted by Rep. John Baldacci, a member of the House Agriculture Committee from Maine. News organizations covered this event, giving the compost school excellent exposure; media interviews have been done at various other sessions to promote composting and the compost school.

The 1999 Biocycle Northeast Conference will be held in Maine and is scheduled for September of 1999. The September 1999 issue of *Biocycle* will focus on composting in Maine and will feature the success of the UMCE Compost School for training composters.

Reported January 1999



A Video of Innovations in On-Farm Marketing in New England

Summary

Fourteen farmers at eight locations were interviewed about their marketing practices during the 1998 growing season. About an hour of raw footage was obtained at each site, including interviews, cover shots of the farm, and specific views of marketing techniques. Responses captured on the raw footage has been transcribed to paper, and the editing process is underway. A complete video, approximately an hour long, will be available for distribution in the spring of 1999.

Objectives

- ◆ Increase awareness among Cooperative Extension educators about the range of strategies and methods that have potential for their clients interested in on-farm marketing.
- ◆ Provide a tool for extension educators that will enhance their capacity to explain and explore direct marketing options with their clients.

Specific Project Results

The eight different farms filmed covered a wide variety of marketing strategies and experiences, including CSA with multiple sales outlets, roadside stand, large-scale CSA, farmers' markets, pick-your own, Internet sales, and wholesale cooperative sales. The 14 farmers were asked to address the following questions during the video interviews:

- Briefly describe your farm operation: location, crop mix, relevant history, people involved.
- Describe your primary markets and how they evolved.
- What are the keys to your marketing success?
- What innovations have you made in recent years that enhanced your marketing?
- Are there innovations you tried that did not work out? Why?
- How do you analyze your markets, customer desires, and customer satisfaction?
- What trends do you see in marketing for horticulture?
- What advice would you give to other farms regarding marketing?

Recommendations

The advisory council had suggested that sales of meat and other products be included in this video. In terms of attracting an audience, a focus on horticultural commodities seemed more advisable than marketing in general, unless the product is to serve a beginning farmer audience.

Dissemination of Information

Availability of the video will be advertised on several subject matter list serves such as vegetable production, direct marketing, small fruit, and sustainable agriculture. The video will also be shown at extension in-service trainings in the Northeast.

Reported January 1999

Coordinator

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Collaborators

University of Connecticut Cooperative
Extension
University of New Hampshire Cooperative
Extension
University of Vermont
Walker Farm
Wishing Stone Farm

SARE Grant

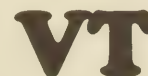
\$18,233

Duration

1997 to 1999

Project Number

ENE97-30





Multimedia Aids & In-Service Training Program for Using Insecticidal Nematodes

Coordinator

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Collaborators:

Cornell University
Ocean Spray Cranberries, Inc.
OARDC
University of Massachusetts
University of Rhode Island
Virginia Tech

Duration

1997 to 2000

SARE Grant

\$59,163

Match

\$275,000

Project Number

ENE97-31

**NJ MA,
RI, VA**

Summary

Biological pest controls, especially insecticidal nematodes, require a knowledgeable user to achieve acceptable results. The goal of this project is to train a multistate cadre of Cooperative Extension personnel in the Northeast on the optimal use of insecticidal nematodes. The training uses multimedia aids, including an instructional video, fact sheets, slide set, web site, and methods manual. These training aids will be used in an intensive workshop; attendees will, in turn, transfer their training to end users in their home states through training sessions and seminars held at commodity meetings.

Eleven committees have formed to support the project. Each committee has completed its planning and submitted an action plan to the project coordinator. As of this writing, every facet of the project is running ahead of or according to the proposal time lines, with one exception: the methods manual, which was to be completed in 1998, has been purposely pushed back to coincide with the training workshop in August of 1999. Most notably, an educational wall poster has already been produced and is being distributed. The instructional video will be completed in January of 1999, ahead of schedule. The web site, an outreach tool that incorporates most aspects of the project, is nearing completion; it will be fully functional in January of 1999. The curriculum for the training workshop has been made final; speakers from around the country have been contacted and the program is in place. The training workshop will be held at Rutgers University on August 29, and 30, 1999. Promotional and registration materials are being prepared for mailing to the potential audience. Each attendee at the workshop will receive a free copy of the instructional video, poster, slide set, methods manual, bibliography, and fact sheets.

Objectives

- ◆ To assemble insecticidal nematode training and resource materials, including instructional video, instructor fact sheets, slide set, web site, computer-searchable bibliography of literature, and methods manual.
- ◆ To use these training and resource materials to educate a multi-state cadre of extension personnel who will transfer this knowledge to end users within their home states and end users in the Northeast through training sessions and seminars held at commodity meetings.
- ◆ To assess the impact of the training program on extension personnel and end users.

Specific Results

Eleven committees have been formed to support each of the project's activities—these are poster, video script, video filming, fact sheets, workshop, web site, bibliography, electronic expert panel, slides, manual, and evaluation committees. The poster committee has completed its assignment of producing a 2.5' x 3' educational wall poster that provides information on the insecticidal

nematode life cycle, behavior, and ecology, as well as the practicalities of crop protection. Two thousand copies of the poster have been printed, and it is already being widely distributed. The video script committee completed its assignment last August and handed off to the video filming committee: the instructional video is presently in rough-cut form, and final editing has begun. Five hundred copies will be ready for distribution by January 30, 1999, well ahead of schedule. The web site will be the focal point for much of the balance of the project. It will incorporate video clips, fact sheets, a bibliography, an expert panel, and a slide gallery. It will also serve as a distribution outlet for the poster and the video. An early version of the web site has been posted to the Internet, and feedback has been obtained from project participants. The web site will be fully functional by the end of January, 1999.

The workshop curriculum has been designed and appropriate speakers have been identified and contacted. There will be three sessions—a lectures session, a hands-on laboratory session, and a field session. These three sessions will involve twelve hours of instruction over two days, and will be held at Rutgers University at the end of August, 1999. Promotional and registration materials on the workshop are being prepared for mailing, and each attendee at the workshop will receive a free copy of the instructional video, poster, slide set, methods manual, bibliography, and fact sheets.

The evaluation committee has completed a detailed action plan. No additional actions were required for 1998, as this committee's functions do not begin until the educational tools are complete.

Potential Contributions and Practical Applications

Adoption of new knowledge and skills by extension personnel and end users cannot be measured until the training phase of the project is complete. A comprehensive evaluation of trainee and end user-impacts of the project will be undertaken upon the completion of the workshop and commodity meetings.

New biocontrol technologies cannot be implemented unless end users are educated in their use. But first, the educators must be educated. Our project will provide extension personnel with the tools to assist end users in using insecticidal nematodes to achieve optimal results in three commodities, each with significant constraints in employing chemical insecticides. These three commodities are cranberries, where water quality is threatened, strawberries, for which chemical agents are unavailable, and turf grass, where the concerns are toxic residues and bird kills.

The training aids will be used extensively in an intensive workshop intended to create a multi-state cadre of instructors made up of extension personnel. This approach will encourage environmentally friendly grower practices and thereby promote agricultural sustainability.

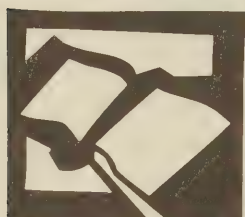
Publicity

The web site created under this project will serve as the primary focal point for all publicity for the project. In addition, the project will be highlighted at the workshop. The workshop will be advertised in the Entomological Society of America (ESA) newsletter and on the ESA web site. Promotional materials on the workshop will be mailed to county agents, extension specialists, and other extension personnel who are in an advisory capacity at land-grant universities in the region.

Reported January 1999

Project Number

ENE97-31



The Farmer's Relevant Voice: A Farmer-Produced Educational Program for Watershed Coordinators

Coordinators

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Collaborators

Area farmers
Canandaigua Lake Watershed
Agricultural Program
Cornell Cooperative Extension

SARE grant

\$50,016

Match

\$30,432

Duration

1999 to 2000

Project Number

ENE97-32

Summary

The purpose of this project is to facilitate the inclusion of the "farmers' relevant voice" in the development and implementation of agricultural environmental-management programs. Through a participatory farmer-to-farmer learning process, farmers are encouraged to discuss economic, institutional, and technical factors affecting the implementation of environmental management practices on farms.

Objectives

- ◆ To enhance farmers' leadership and authority in the coordination and design of agricultural environmental-stewardship programs through their active involvement in the production and dissemination of a video-based educational program for watershed coordinators.
- ◆ To increase awareness among agricultural professionals of farmers' economic, environmental, and social perspectives of agricultural environmental management.
- ◆ To stimulate recognition by agricultural professionals of the farmers' interaction networks and the potential role of these networks in the development, implementation, and critical analysis of agricultural environmental management programs.

Project Narrative

Critical issues identified by farmers included the need for a decision-making voice on watershed management boards, economic incentives outside of cost-share programs to allow farmers to maintain farm economic viability while implementing environmental practices, the potential environmental and economic benefits of integrating farm environmental management, farmland protection, and agricultural economic development efforts, and the need to increase public awareness of farmers' efforts to protect environmental quality.

In the second year of the project, participants will address these concerns through a series of farmer-based training meetings on how to form and maintain farmer advisory boards to watershed programs. Other meetings will facilitate farmer-based discussions of potential environmental incentives through banks, insurance companies, landowners, and watershed groups. A video illustrating farmers' issues, experiences, and alternatives will assist participating farmer groups to integrate their recommendations into local watershed programs.

Project Activities and Results

Case-study interviews with farmers and farmer focal group meetings identified a diversity of perspectives, accomplishments, opportunities and recommendations regarding the implementation of farm environmental-management practices. Throughout the discussions, farmers provided illustrations of the need to integrate and balance environmental, economic and policy issues. Perspectives expressed by farmers included the need for flexibility in environmental regulations to permit adapting practices to local conditions and the perceived inequities in the allocation of government funds to farmers with lower levels of environmental management, rather than rewarding farmers who have used their own funds to address environmental concerns. Also discussed was the unwillingness of some farmers to openly discuss practices or their perspectives on government programs due to per-



ceived risks of litigation or denial of access to cost-share assistance. Other concerns were limited follow-up on technical and management assistance provided to farmers following implementation of best management practices, the difficulties in addressing some environmental concerns due to confounding environmental risks and benefits associated with some farm management practices, and the perceived limited understanding by the non-farm community of the economic risks of farming and farmers' efforts to address environmental concerns. Farmers felt that this limited understanding can foster farm-neighbor conflicts while hindering farmers' ability to negotiate within watershed based programs.

Participants noted that for conservation-minded farmers and good farm managers, the benefit of addressing environmental concerns to the sustainability of the farm operation made sense, but participating farmers were also concerned that this common sense is not common to all farmers.

Group and individual discussions revealed how farmers have responded to these concerns, as individuals and as part of organized groups. Farmers in the Canandaigua Lake Watershed serve on a watershed program board. They are responsible for identifying priority environmental concerns and recommending priority practices to address these concerns. They are also involved in the selection of Soil and Water Conservation District personnel. Farmers in the Cayuga Lake Watershed serve on the board of directors of the Watershed Management Program and are involved in policy development and land-use planning. In several counties, farmer-to-farmer meetings have facilitated farmer implementation of sustainable farm environmental practices and conservation tillage practices. Several groups have identified potential linkages between economic incentives and environmental management practices including favorable insurance rates, decreased land rental rates, economic assistance from local community organizations and "green label" programs.

Although each of these activities has significant local impact, knowledge of these activities and attempts by other watershed groups to build on these

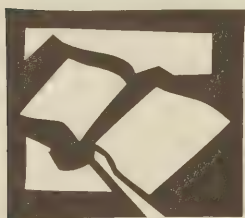
successes is limited. In January of 1999, farmers will discuss their work with watershed advisory boards and incentive programs during agricultural agency training meetings. Personnel who will be attending these meetings are responsible for implementing agricultural environmental management programs. Also, in the second year of the project, farmer-based training meetings will bring together farmers from across the state to share their experiences. Meetings will focus on two priority issues: the processes for forming and maintaining farmer advisory groups and ensuring that these groups have an effective impact on watershed program development, and identifying the processes to implement incentive programs that reward good environmental stewardship. Two short videos based on these meetings will be developed, highlighting farmers' perspectives and recommendations. Farmers will be able to use this video, along with accompanying written materials, to facilitate the initiation of advisory boards and incentive programs with watershed programs. A video company familiar with agricultural, environmental, and watershed issues has been contacted.

Recommendations

This project has revealed a continuing need to increase the awareness of participatory programs and the ability of both farmers and agency personnel to implement interactive programs. Prior involvement in more structured training programs inhibited some farmers from raising certain concerns and from taking leadership in project development. The time commitments associated with participatory programs can inhibit involvement by farmers who may be willing to spend time for discrete project, such as an interview or a meeting. Participatory programs must accommodate farmers' time schedules. Programs that involve farmers from a variety of sectors must operate creatively and allow for delays in project implementation to allow all participants to become involved.

Reported December 1998

Project Number
ENE97-32



Review & Evaluation of Educational & Reference Materials Pertaining to Nutrient Management & Soil Health

Coordinator

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Collaborator

Rutgers Cooperative Extension

SARE Grant

\$7,000

Duration

1998 to 1999

Project Number

ENE97-37

36

Summary

This project is gathering and evaluating materials on soil tilth, organic matter, percolation, erosion, microbial balance, nutrient holding capacity, and soil structure. The overall goal is to develop a nutrient management and soil health curriculum for agriculture professionals.

Objectives

- ◆ Collect and purchase materials related to nutrient management and soil health for review.
- ◆ Evaluate these materials based on their quality and accuracy.
- ◆ Select materials to be use for future nutrient management and soil health workshops.
- ◆ Identify gaps in this information and make recommendations for the creation of new materials.
- ◆ Assemble a complete binder of information to be used for future tours and workshops. The binder will be the three-ring type, and will be added to in future programs. Additional material like side sets and videos may also be included. Videos and larger publications will be indexed, described, and made available for loan.

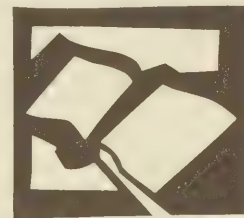
Results to Date

In the summer of 1996, the Northeast SARE Professional Development Committee identified three areas that needed attention as educational programs—nutrient management and soil health, holistic decision making, and the rural-urban interface. A committee looked at the information available for nutrient management and soil health, and was awarded \$7,000 to investigate the available materials and develop a reference tool for future training. The eight committee members were from five states: Maine, Maryland, New Jersey, Pennsylvania, and Vermont.

During 1977 the members identified and collected the materials; in April of 1998, the group categorized and selected materials in include in a package of information to distribute to leaders in sustainable agriculture in the Northeast. The package was distributed to the Northeast SARE Professional Development Committee program representatives from each of the 13 states at the February 1999 meeting at Pennsylvania State University.

Reported January 1999

ME
MD
NJ
PA
VT



Riparian Buffer Systems Training

Summary

Vegetated riparian buffers have been identified as an effective filter for non-point-source pollution. On agricultural lands, vegetated buffers reduce nutrient and sediment loads in streams by slowing overland flow and reducing stream bank erosion. In addition to their water quality benefits, riparian buffers provide a critical habitat for many aquatic and terrestrial animals. Vegetated buffers can provide benefits to landowners and rural communities through enhanced recreational and aesthetic appeal and enhanced farm income. In response to these benefits, many riparian buffer initiatives have been implemented throughout the northeast region and in the US.

Objectives

- ◆ To train resource managers in the northeast and mid-Atlantic region in riparian buffer functions, values, establishment, enhancement, maintenance, and buffer design site evaluations.
- ◆ To understand and apply site assessment criteria and management options of riparian buffers in both the urban and rural settings.
- ◆ To enable resource managers to make informed management recommendations for establishment, enhancement, and maintenance of riparian buffers.
- ◆ To provide up-to-date resource materials and research findings on the science of riparian buffer management.
- ◆ To think of a riparian buffer as a system and recognize its critical components.

Project Narrative

The purpose of this project is to provide the resource professionals who work with landowners and communities the information they need to successfully design and install a riparian buffer. Critical training components include riparian buffer enhancement, installation, and management. A two-day training program was developed that included one day in the classroom and the second day in the field. This project incorporated three educational delivery systems: a satellite broadcast, which was four hours of key information presented by nationally recognized experts, on-site classroom training, made up of three hours of technical information delivered by local experts, and field trips to local farms, which was eight hours of field training on site assessment criteria and application of knowledge gained through case studies.

Day one included a variety of classroom instructors and teaching techniques. The training occurred simultaneously in ten eastern states. All sites participated in a half-day satellite broadcast from the University of Maryland at College Park. The broadcast focused on the basic structure and ecology of riparian buffers and covered the dynamics of riparian buffer systems, nutrient cycling potential of riparian buffers, principles of groundwater hydrology, in-stream system and aquatic considerations, determining buffer width, and economic concerns and opportunities. The satellite broadcast was followed by additional on-site instruction in the afternoon that addressed local concerns presented by local experts. Afternoon training generally included topics such as selection of appropriate plant materials, stream bank stabilization and bioengineering, and wildlife habitat considerations. These topics varied by state and allowed the afternoon training to be tailored to each state's immediate needs.

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Collaborators

Chesapeake Bay Program
Maryland Forest Service
NEFREC
NENREM
US Forest Service

SARE Grant

\$20,500

Match

\$5,000

Duration

1997 to 1998

Project Number

ENE97-33

**MD, NY
PA, MA
NJ, VA**

For example, specific topics taught in Maryland included stream system concerns and using bioengineering techniques, site design and selecting the proper tree species, herbaceous materials, and wildlife habitat considerations.

Day two took place in the field on local farms. It involved application of site assessment techniques in both urban and rural settings. Emphasis was placed on practical information for assessment and developing management strategies. The training format included team problem solving and case studies. Multidisciplinary teams were developed and assigned a series of case studies to solve. Each team consisted of eight to ten resource professionals with different backgrounds. This approach allows individuals from different agencies and backgrounds to work together and build a better understanding of each other's programs, technical specialists, and overall perspective.

This training targeted the northeast and mid-Atlantic agricultural extension agents, forestry and wildlife specialists, soil conservationists, and other resource professionals who work with farmers, rural landowners, and communities to manage farmlands, open space, forests, streams, wildlife, and fisheries.

Project Results

A two-day training program was developed and delivered to ten states, with forty-four downlink sites and about 900 participants in New York, Pennsylvania, Maryland, Delaware, Virginia, Connecticut, Massachusetts, Maine, New Jersey, and Ohio. Forty-four satellite downlink sites were used.

The training attracted people with a range of educational and professional backgrounds. For example, there were participants with associate degrees, bachelor's degrees, and doctorates. The professional backgrounds included agricultural sciences, environmental sciences, fish and wildlife management, forestry, biology, ecology, watershed management, geology, soil science, agronomy, engineering, public health, planning, water re-

sources, landscape architecture, resource policy, resource economy, water and electric utility specialties, environmental consulting, soil and water conservation, and environmental education. The average number of years of experience of all participants was approximately fourteen, with a range from one to thirty-two years.

Pre- and post-tests were given to all participants for the satellite training. In all of the satellite broadcast subject areas, all participants raised their level of knowledge by .7 on a scale of 1 to 5, with 1 being a low level of knowledge and 5 being a high level of knowledge. For example, the pre-test score on the dynamics of riparian systems was 2.9 before the training; it rose to 3.9 after it. These results were consistent through the six categories tested.

As a result of this training, four other states outside the region—Kentucky, Texas, Washington, and Michigan—have requested training materials so they can begin to develop a similar training program in their state. Additionally, many of the states that participated in this program are developing other training programs, both for professionals and landowners, that would teach the science of riparian buffer systems.

Training materials developed for this effort included a series of seven fact sheets and a three-ring binder of resource materials that included speaker notes, research documents, publications on riparian buffers from numerous agencies, fish and wildlife management options, forest management options, and other material relating to riparian buffers. Also available to all participants was the USDA Forest Service manual, "A Riparian Forest Buffers—A Technical Guide for the Chesapeake Bay Region," and a video produced by the University of Maryland Cooperative Extension, "Riparian Forest Buffers—the Link Between Land & Water."

Recommendations

There is a need for similar programs targeted at landowners, and ought to be a local program given by local experts. The satellite broadcast was a great way to deliver critical scientific information to a large number of people at the same time, but it does have its limits. There is still a need to survey all participants a year after the training to evaluate overall effectiveness in this project. The true indicator of success will be the number of future programs given on riparian buffer systems, the number of new riparian buffer projects, and any new resource information developed on riparian buffer systems.

Additionally, there is an opportunity to evaluate the effectiveness of the satellite broadcast in delivering technical information. Future funding could be targeted with this outreach media. If future extension programs try to use this technology, it would be helpful to know how effective it is in delivering technical information.

Reported December 1998

Project Number

ENE97-33



A Comprehensive Training in Sustainable Agriculture

Coordinator

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Collaborators

Cornell University Farming
Alternatives Program
NRCS
New England Sustainable
Agriculture Center
UVM Center for Sustainable Agriculture

SARE Grant

\$122,000

Duration

1998 to 2000

Project number

ENE97-³⁶₃₅

Summary

This project is developing skills and tools for sustainable agriculture leaders in several regions in the Northeast. As a result, the leaders will be better equipped to engage farmers, colleagues and community members in holistic approaches to the challenges and opportunities that face agriculture.

Objectives

- ◆ Increase knowledge and understanding about sustainable agriculture systems.
- ◆ Identify and adapt educational and management tools and techniques that can be used by the agency personnel and farmers.
- ◆ Increase leadership capacity and produce stronger networks.

Results to Date

Five regional teams have formed and leaders have developed a list of outcomes for the project. Teams have developed projects that address topics relevant to their own regions.

Surveys were created to assess the information needs of those participating in the project and to assess the participants' current level of understanding of sustainable agriculture and the specific tools that this project is focusing on.

Methods

Originally we had planned to work intensively with a group of ten to twenty Cooperative Extension and NRCS personnel from Vermont and New York to broaden their appreciation and enhance their understanding of the philosophy, scientific principles, and practical application of sustainable agriculture. This training would serve client interests and help lay the groundwork for a future farming and food system that is profitable, environmentally sound, and socially just.

After the original proposal was submitted, the Northeast SARE administrative council asked that the project be expanded regionally. Therefore, the project now includes five teams of eight to ten from around the Northeast.

The first task was for the team leaders and the organizing committee to develop a list of outcomes, which have guided us through the development of the training activities. The teams then put together preliminary plans for projects that addressed topics relevant to their own regions as well as the overall goals of the comprehensive training.

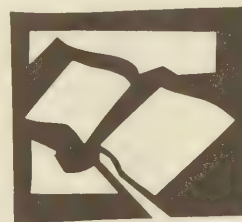
A comprehensive classroom training took place in January of 1999 in Williamstown, Massachusetts. The event addressed each of the outcome areas, and participants learned about approaches like whole-farm planning or participatory education. These are tools they can bring to their own regional team projects, and be integrated in all their work with farmers that addresses sustainability.

After the January training, teams will implement their own regional projects. Comprehensive training funds of \$4,000 per team per year are allocated to support regional activities. At the end of the two years, in the spring of 2000, the whole group will meet again to discuss how well the project has achieved its outcomes.

Reported December, 1998

NY
VT, CT
MA, ME
NH, RI

How to Keep Agriculture Sustainable: Training Trainers on Conserving Farmland & Resolving Land Use Conflicts in the Delmarva Peninsula



Summary

This project will train Cooperative Extension, NRCS, and other USDA field personnel about farmland protection issues. A diverse group will develop curricula, produce standardized information packages, provide training events, and conduct a community-based outreach effort on farmland protection issues. The goal is to provide assistance to communities where pressure from fast-growing metropolitan areas threatens the region's agricultural future.

Objectives

- ◆ Help extension, other USDA field personnel, and leaders from farm organizations such as Farm Bureau, the Grange, and commodity groups and vocational agriculture teachers to examine and increase their role in land use education and public policy.
- ◆ Teach agricultural educators and leaders how to protect farmland and resolve conflicts related to neighbor relations and competition for land.
- ◆ Develop a core curriculum, informational materials, and access to resources to carry out these workshops and to provide materials for community workshops in the future.

Abstract

American agriculture increasingly is being practiced on the edge of expanding urban areas. This adds competition for land and land use conflicts to the host of economic and environmental challenges modern farmers face. These result in escalating land values and property taxes, making it hard for farmers to buy or rent land, expand their operations, or transfer their land to other farmers. New neighbors often complain about the sights, smells and sounds of commercial production.

The long-term sustainability of agriculture is tied directly to the quantity and quality of land that is available to farm. On the Delmarva Peninsula, this tie is particularly strong. The peninsula supports one of the most productive agricultural areas in the Northeast. Although farming has defined the Delmarva's spirit and landscape for centuries, its future is in question. Escalating pressure from fast-growing metropolitan areas in the mid-Atlantic place the peninsula as the ninth most-threatened agricultural area in the country. Communities in the peninsula are recognizing the problem and looking for solutions, and they are asking extension and other educators for help.

This project will provide the answers and guidance these communities need by training extension, NRCS and other USDA field personnel about farmland protection issues. The American Farmland Trust is working with Delaware and Maryland Cooperative Extension and a diverse group of stakeholders to develop curricula, produce standardized information packages, train trainers, and subsequently conduct a larger community-based outreach effort on farmland protection in the Delmarva Peninsula.

Approved for funding March 1998

Coordinator

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Collaborators

American Farmland Trust
Delmarva Peninsula Farmland
Preservation Education Project
University of Delaware
University of Maryland

SARE Grant

\$77,282

Match

\$30,602

Duration

1998 to 2000

Project Number

ENE98-37

DE
MD
VA



Organic Grain Production: Another Way

Coordinator

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Collaborators

Area farmers
Cornell University
Delaware State University
University of Maryland
Pennsylvania State University
Rutgers University

SARE Grant

\$90,100

Match

\$22,525

Duration

1998 to 2000

Project Number

ENE98-38

MD
DE
PA
NJ
NY

Summary

This project responds to increased demand for certified organic grain and rising farmer interest in alternative grain production systems by providing resources that Co-operative Extension personnel can use to support producers. Another Way will develop an educational package consisting of two videos, an organic grain systems resource directory, and regionally specific fact sheets.

Objectives

- ◆ Provide an educational video capturing the holistic decision making process required when exploring organic grain systems as an alternative farming system.
- ◆ Provide education to extension personnel and other agricultural professionals in the how-to of organic grain production, specifically planting, cultivation, nutrient management, cover crops, harvesting, pest management, and grain marketing.
- ◆ Provide education with regionally specific fact sheets on organic grain systems.
- ◆ Provide an organic grain systems resources directory for the mid-Atlantic region.
- ◆ Provide extension personnel and other agricultural professionals with incentives to become the facilitator for organic grain study groups throughout the region.

Abstract

The 1995 Farm Bill reduced government involvement in agriculture by reducing government subsidies. Prior to this, farmers were given incentives to follow certain cropping rotations, which served to control land in production and, in effect, controlled supply. This incentive program geared farmers to follow incentives instead of true market indices.

About this same time, scientists were making major advancements in biotechnology. Bovine somatotrophin (BST) was one of the first significant breakthroughs in biotechnology. This technology, along with genetically engineered plants, follows the high-production priorities that agriculture has adopted in recent years.

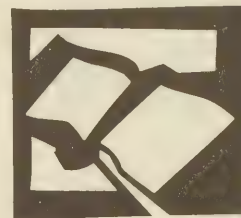
But during this same time, four relatively large organic dairy companies were organized and assumed positions in the marketplace. Since then there has been a significant increase in organic dairy farms in the mid-Atlantic region.

With increased organic milk production, an increased demand for organic feed has developed. This increased demand has stimulated extension personnel and many non-organic cash grain farmers to explore organic grain production as "another way," an alternative farming that meets market demand. This farming alternative, however, demands a tremendous paradigm challenge. Although organic farming requires a thorough understanding of best management practices, it requires us not to use the biotechnology and chemistry developed in recent years.

Another Way will provide extension educators of the mid-Atlantic region a professional development program that will address this paradigm shift. It will also address the critical growing-point decisions that will be required for successful adoption of organic practices. This component of the program will focus on maximizing sustainable practices of pest management, nutrient management, and the use of cover crops.

Approved for funding March 1998

Northeast Training & Support Network for Agriculture Development



Summary

This project aims to strengthen community and regional infrastructure for farming in the Northeast by enhancing the agriculture development skills of Cooperative Extension, USDA, nonprofit, and state and local agency staff and farmers. Agricultural development is a strategic process of community and economic development aimed primarily at improving the sustainability of farming. The project will provide intensive training to a leaders group of up to 30 people. An additional 300 to 400 people will also receive training and support. Topic areas include expanding direct marketing opportunities for farmers, developing new marketing cooperatives and strengthening existing ones, connecting farmers with ethnic and specialty markets, expanding agritourism, fostering value-added processing, and helping farmers gain access to supermarkets, restaurants, and other institutions.

Objectives

- ◆ Provide in-depth training and intensive cross-learning experiences in community-based and regional agriculture development to a leaders group of 24 to 30 extension, USDA, non-government organizations, state and local agency staff, and farmers from around the Northeast.
- ◆ Develop the capacity of participants to critically evaluate their own agriculture development programs in terms of economic, environmental, and social impacts.
- ◆ Provide additional training, networking support, information, and documented case examples of agriculture development to up to 400 northeast cooperative extension, USDA, non-government organizations, state and local agency staff.

Abstract

In the Northeast, increasing the sustainability of agriculture will depend on developing marketing and other support systems that link farmers with the consumers in the region, create incentives for environmentally sound farming practices, and increase the farmer's share of the consumer's dollar. Agriculture development is a strategic economic- and community-development process aimed at achieving these goals. Successful agriculture development improves the economic sustainability of farming while providing environmental and social benefits to the community and region.

This project will provide intensive training to a leaders group of 24 to 30 participants. Additional training, networking support, and information will be provided for an audience of 300 to 400. As a result of this project, participants will be able to provide more effective leadership for a wide range of community-based and regional agriculture development opportunities in the Northeast.

Project activities include an initial Agriculture Development Leaders Group Meeting, publication of 20 to 24 agriculture development project profiles, a web site, participatory evaluation studies of four model projects, four two-day study tours of the model projects, and a major three-day Agriculture Development Training Symposium.

Approved for funding March 1998

Coordinator

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Collaborators

Community Involved in Sustaining
Agriculture
Cornell Cooperative Extension
Howard County Economic
Development
Lancaster Chamber of Commerce
New York Department of Agriculture
Orange County Agricultural &
Farmland Protection Board
PASA
USDA Rural Development
Vermont Department of Agriculture,
Food & Markets
Wayne County Agricultural &
Farmland Protection Board

SARE Grant

\$132,392

Match

\$86,836

Duration

1998 to 2000

Project Number

ENE98-39

all states



A Diagnostic Team Approach to Enhancing Dairy Farm Sustainability, Phase II

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Collaborators

Area feed dealers and veterinarians
Pennsylvania Cooperative Extension
Pennsylvania State University
PennWest Farm Credit
PFB Financial Services
Private consultants

SARE Grant

\$50,000

Match

\$42,543

Duration

1998 to 2000

Project Number

ENE98-40

Summary

Consumers want a safe food supply and farming practices that make wise use of non-renewable resources. Northeast dairy farms need to optimize whole-farm management by learning new concepts from off-farm talents in order to control costs and produce a quality product.

Objectives

- ◆ To train dairy farm advisors and consultants to implement ongoing local diagnostic and planning teams to combat important threats to dairy farm stability,
- ◆ To encourage the use of the team approach.

Abstract

Local agricultural professionals throughout the Northeast have expressed an interest in using teams to expand their skills in problem solving, critical thinking, and whole-farm management. These professionals will learn and practice on project farms for one year, and the information gained about teams and their effectiveness will be disseminated through demonstrations, farmer panel discussions, conferences, and publications.

This is a phase-two proposal. In phase one, many discoveries were made working with the first 15 advisory teams. These teams set realistic goals and diagnosed critical problems in a timely manner. We learned in phase one that professional advisors made superior advisory team coordinators; teams led by producers were less organized and failed to meet regularly. This proposal, in phase two, is directed at correcting this problem.

Approved for funding March 1998



Increasing Producer Adoption of Pasture as Part of a Whole-Farm System



Summary

This project will be to produce a video describing the benefits of a well managed pasture in a diversified livestock operation. One hundred copies will be distributed to select USDA, Soil and Water Conservation District, and Cooperative Extension staff in New York. The project's evaluation phase will look at how the video was used and whether it contributed to decisions to adopt managed pasture approaches.

Objectives

- ◆ Improve the education of USDA staff, soil and water conservation staff, and extension agents in order to increase the awareness of dairy and livestock producers about the value of well-managed pasture in a diversified livestock operation.
- ◆ Increase the number of dairy and livestock producers who adopt the use of pasture into a whole farm planning system.
- ◆ Create a professional video and resource packet to increase awareness of USDA staff, soil and water conservation staff, extension agents, and dairy and livestock producers to the value of well-managed pasture in diversified livestock operations.

Abstract

A professional video describing the benefits of well-managed pasture in a diversified livestock operation will be produced. One hundred copies of the video will be distributed to selected USDA staff, soil and water conservationists, and extension staff in New York State. The primary objective of this video is to increase awareness of how the use of intensive rotational pasture could fit into a diversified livestock operation. This video will include producer testimonials highlighting the hurdles encountered during the implementation of their managed pasture rotation program, research information on new grass varieties, and the economic considerations of rotational pasture.

A catalog of pasture resources will be provided to the viewer upon the return of the evaluation survey card enclosed with each video. Evaluation of the project will be tabulated from survey card responses, a telephone survey of agency staff regarding how they distributed the video to livestock and dairy producers, and a second phone survey to measure the number of producers that adopt managed intensive grazing as a result of viewing the video.

Approved for funding March 1998

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Collaborators

Cornell University Cooperative
Extension

SARE Grant

\$30,393

Match

\$9,542

Duration

1998 to 1999

Project number

ENE98-41





Feeding Our Cities: Establishing a Strong Urban-Sustainable Agriculture Interface in Southern New England

Coordinator

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Collaborators

Area planning departments &
nonprofits
Connecticut Department of Food
& Agriculture
Groundwork Trust
Hartford Food System Project
Massachusetts Department of Food
& Agriculture
University of Connecticut Extension
University of Massachusetts

Duration

1998 to 1999

SARE Grant

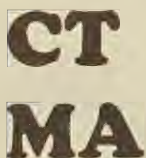
\$6,500

Match

\$4,600

Project Number

ENE98-42



Summary

The proximity of farms to urban areas in Connecticut and Massachusetts offers producers and city residents an opportunity to bridge the gaps between urban and agricultural communities, and training in food and sustainability issues and practices will facilitate these connections.

Objectives

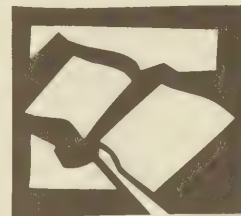
- ◆ To understand the issues facing urban, sustainable agriculture, and rural communities in densely populated places such as Hartford, Springfield, Holyoke, Bridgeport, New Haven, Worcester, and Boston.
- ◆ To increase the dialogue between rural and urban communities through an open exchange of ideas to foster better understanding, and through working together toward solutions that best meet urban food needs through rural and urban sustainable agriculture practices.
- ◆ To build alliances among southern New England land grant universities, Cooperative Extension educators, USDA, and other agencies and organizations, city planners, policy makers, land preservation groups, sustainable agriculture farmers, community gardeners, community supported agriculture projects, chefs' collaboratives, green markets, and city residents.
- ◆ To work cooperatively with these groups to identify problems and seek solutions to issues of food and sustainable agriculture in and near urban areas.
- ◆ To implement programs based on increased dialogue, greater understanding, and new alliances to establish the interface needed to satisfy food needs and protect and maintain the environment we share.
- ◆ To enhance regional food production and distribution to conserve energy and provide for a more sustainable agricultural system.

Abstract

This project will build on existing efforts to create a strong interface between urban and agricultural communities. Extension educators and USDA field staff can play a significant role in these alliances by learning to work cooperatively with urban communities and farmers, and can help to identify current problems and issues, explore solutions, and ultimately satisfy a larger portion of our cities' growing need for secure, safe, and nutritious food. Participants in the training will visit existing initiatives, meet with city planners and policy makers, identify issues and problems with food and agriculture organizations, and create broad networks and alliances to find workable solutions.

Approved for funding March 1998

Nutrient Management Education: Development & Implementation of Training Modules on Basic Principles, Current State of Knowledge & Advances in Research



Summary

Nutrient management planning (NMP) is an essential component of all land-use programs that involve the application of nutrients to the soil, whether in the course of production agriculture, residential and commercial landscaping, or land reclamation. The efficient use of nutrients results in savings to the farmer, the homeowner, the land manager, and prevents the unnecessary loss of nitrogen or phosphorus that can harm ground and surface waters.

Objectives

- ◆ To prepare training module slide sets on key aspects of nutrient management for use in education programs for practitioners.
- ◆ To develop supportive materials, including educational handouts and interactive exercises, for use in the program.
- ◆ To provide the initial training using the eight modules specified to Cooperative Extension personnel and others from state and local agencies.

Abstract

This project will develop and implement a series of training modules that will be used to educate and update people involved in NMP, including Cooperative Extension personnel, conservation planners, nutrient management consultants, and others with a stake in NMP. The goal is to insure that, at the conclusion of the project, the participants will have a consistent base of training on which they can develop sound nutrient management plans. Extension staff will then be able to take their training and the materials—slide sets and supporting information—and offer programs to NMP to other groups in their respective areas.

Approved for funding June 1998

Coordinator

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Collaborators

Delaware Department of Agriculture
Delaware Association of Conservation
Districts
Delaware Department of Natural
Resources & Environmental Control
University of Delaware
USDA-NRCS

Duration

1998 to 1999

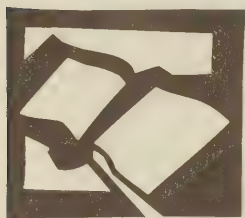
SARE Grant

\$6,500

Project Number

ENE98-43

DE



Locally Led Farmer Groups for Sustainable Agriculture: The Study Circle Approach

Coordinator

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Collaborators

Future Harvest Project
Maryland Cooperative Extension

Duration

1998 to 1999

SARE Grant

\$6,500

Match

\$7,500

Project Number

ENE98-44

Summary

Study circles are a simple, powerful method for learning because they build on the knowledge of group members rather than teaching in a traditional, top-down way. Study circles exchange information about specific practices, increase understanding of different points of view, strengthen collaborative relationships, and increase critical thinking. Experience and research suggest that farmers value and integrate information more readily when it is obtained from other farmers.

Objectives

- ◆ To enhance knowledge of sustainable agriculture principles and methods for Cooperative Extension personnel and farmers through a collaborative learning process
- ◆ To introduce co-learning methods to the Maryland Cooperative Extension.
- ◆ To provide training and support to the Maryland Cooperative Extension to improve farmer-to-farmer networking and learning.

Abstract

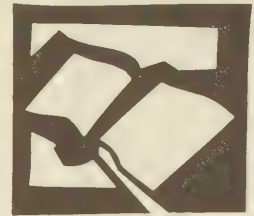
The Future Harvest Project (FHP) is a network of farmers, agricultural professionals, landowners, and consumers in the Chesapeake region working together to promote sustainable agriculture. One of its projects of the past year has been to implement and support locally led farmers groups, also known as study circles. The study-circle model has been adopted in many states; in the Chesapeake region, FHP has used the model in farmer-to-farmer learning by encouraging the establishment of two study circles on sustainable agriculture.

This project will expand the existing study-circle program by increasing the number of study circles; this will be done by training cooperative extension agents in Maryland, Virginia, and Delaware and by supporting their efforts to lead study circles.

The project will offer financial and logistical support to extension agents and other agricultural professionals. Because the study circles emphasize co-learning, we believe that the extension personnel will learn from the farmers as they facilitate and co-lead their study groups.

Approved for funding June 1998





Reinventing the Appalachian Shepherd

Summary

Shepherds in West Virginia are leaving the business at an alarming rate. A recent wool-poll survey of the state's shepherds revealed that, although predation is a growing problem that has cost over \$300,000 annually, predation was ranked equally with old age, too much work, and too little profit when farmers were asked why other farmers were leaving the sheep business. A recent National Agriculture Statistics Service summary reports that West Virginia has fewer than 1,000 shepherds managing 35,000 breeding ewes. Thirty-five-ewe flocks produce no significant income for their owners, yet sheep farming has a role to play in the farming structure of the Appalachian region.

Objectives

- ◆ To define an economically viable, important agricultural production unit.
- ◆ To increase the understanding of the regional faculty of the American sheep industry, along with how it varies by region and internationally.
- ◆ To broaden the understanding of the similarities among many agricultural production enterprises, including hogs, dairy, beef cattle, and poultry as well as sheep.
- ◆ To learn what is required to maintain an economically important flock of sheep, including management, feed, labor, facilities, and marketing requirements.
- ◆ To understand and teach methods of predator control, especially with guard dogs and donkeys.
- ◆ To develop group understanding of decision making based on a cost-per-unit analysis.
- ◆ To teach the group how to help a producer with enterprise selection, budget analysis, business plan, and lender protocol.
- ◆ To enhance understanding of forage production from soil health to harvest.
- ◆ To expose the group to intensified production strategies.

Abstract

This project will teach Cooperative Extension agents, USDA personnel, and shepherd leaders management paradigms in both sheep and non-sheep large-scale production agriculture, and will identify elements in a different shepherding protocol. The goal is to develop group understanding of the components of large-scale agricultural systems and the advantages they present, and to study the appropriateness of incorporating management themes into sheep production that is economically significant.

The finished product will be a trained cadre of extension educators and other personnel who can introduce these new ideas to grass farmers in their states. There will be a series of workshops held, and learning materials will be posted on the West Virginia Sustainable Agriculture web site.

Approved for funding June 1998

Coordinator

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Collaborators

American Sheep Industry
Association
Ohio State University
Pennsylvania State University
Virginia Tech
Wellman, Inc.
West Virginia Farm Bureau

Duration

1998 to 1999

SARE Grant

\$6,500

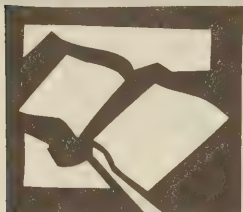
Project Number

ENE98-45

WV

PA

VA



Conducting On-Farm Research: Enabling Farmers to Implement Sustainable Change in Agriculture

Coordinator

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Collaborators

University of Delaware
University of Delaware Cooperative
Extension
University of Delaware
University of Maryland Cooperative
Extension
Wye Research & Education Center

Duration

1998 to 1999

SARE Grant

\$50,000

Match

\$18,000

Project Number

ENE98-46

MD
DE
PA
WV
NJ

Summary

Farmers in the mid-Atlantic region and the Chesapeake Bay watershed have seen increased awareness over the past two decades of the environmental impact of farming. High nutrient levels in the Chesapeake Bay have had environmental consequences; this has coincided with growing public concerns about the use of pesticides in food production. Growers wish to produce food in an environmentally sound way, but are constrained by the risk of losses.

Research has shown that new practices can maintain profitability and still reduce the environmental consequences of farming. The risks associated with changing production practices have kept some of these practices from being widely adopted. Education, specifically education with the active participation of farmers, is the final step toward adopting new agricultural practices.

Objectives

- ◆ To evaluate the needs of the target audience of farmers, and to enhance their ability to conduct valid on-farm research.
- ◆ To conduct training on planning, implementing, and interpreting on-farm research for field and vegetable crop producers, and to demonstrate experimental design, layout, and techniques through farm tours of test plots.
- ◆ To train participants to evaluate results and apply statistical and economic analyses; discussion will be held on how to make valid conclusions and what inferences can be drawn from various studies.

Abstract

Farmers face many challenges in adapting their production practices in the coming decades—environmental concerns have increased and, while rural and urban communities are concerned about impacts, they also appreciate the agricultural values, lifestyle, and open space farms offer. Farmers are struggling to lessen their environmental impact, strengthen community relationships, and improve their satisfaction with farming.

To achieve all this, farmers must choose wisely among emerging practices; this choosing process will depend on the validity of on-farm evaluations. We will conduct on-farm research training for farmers, Cooperative Extension educators, and consultants in Maryland, Delaware, Pennsylvania, West Virginia, and New Jersey.

Approved for funding June, 1998



urban-farm connections



Sea Change Urban Horticulture Center: Sustainable Agriculture Initiatives

Summary

This project is evaluating a prototype Community Supported Agriculture (CSA) operation initiated by Sea Change and staffed by residents of a designated Empowerment Zone in Philadelphia. The project incorporates the experiences of the CSA startup and seeks to expand the CSA, particularly in the specialty-produce and cut-flower markets. The project will also evaluate container growing and the marketing of trees and shrubs in an urban setting.

Objectives

- ◆ To evaluate staff training, production, and farmers market operations for a prototype CSA staffed by inner-city youth.
- ◆ To establish a CSA staffed by residents of the Philadelphia Empowerment Zone and expand the area in production, focusing on developing vacant land close to Sea Change.
- ◆ To establish and evaluate a specialty herb and produce operation offering organically grown specialty items to urban restaurants and food specialty businesses.
- ◆ To expand an existing tree nursery and evaluate over three years the growing of shrubs in this inner city environment.
- ◆ To compare urban and suburban production, and to evaluate the effect of urban conditions on food production.
- ◆ To establish a large cutting garden at the Urban Horticultural Center, and to train staff in the preparation and marketing of cut flowers produced on site.
- ◆ To evaluate three-year outcomes, both horticultural and economic, to support economic development and sustainable agriculture in other urban areas.

Key Results

In May of 1997 the CSA became a certified organic farm, and 33 families were shareholders. The tree nursery was in place, and local youth were at work on the CSA. But, also in 1997, Sea Change was informed that they must vacate a plot of land in North Philadelphia leased from the Redevelopment Authority because of growing development pressures.

In response to this unexpected development, Sea Change is now exploring the use of two parcels in Roxborough and has negotiated one more year of use on Redevelopment Authority land. There is also garden space at Awbury Arboretum.

During the past year, Sea Change initiated the establishment of the Inner City Growers Association, or ICGA, to support urban farming. Goals for the coming year include recruiting two to six new urban farmers, identifying new potential garden sites, connecting growers to technical assistance, and offering marketing assistance, including potential cooperative sales.

Sea Change has also been selling organic produce to local restaurants. Sea Change enjoys a strong local profile, and the CSA and other projects have been featured extensively in the local press. The role of urban agriculture and horticulture in economic development will continue to be explored and evaluated.

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Collaborators

Sea Change, Inc.
Temple University
Philadelphia Empowerment Zone
Beech Corporation
Reading Terminal Farmers' Market Trust
Pennsylvania Horticulture Society

SARE Grant

\$156,500

Match

442,500

Project Number

LNE96-77

Reported January 1998



vegetables



At-Harvest Stalk Nitrate Testing for Sweet Corn

Summary

Growers evaluating new practices, such as the Pre-sidedress Soil Nitrate Test (PSNT), are interested in relating observations about crop performance at time of harvest to their N fertility program. To learn more from field observations, growers needed a simple diagnostic test to evaluate crop N status at time of harvest. The At-harvest Stalk Nitrogen Test (ASNT) was developed for this purpose. It indicates whether an inadequate, optimal, or excessive amount of N fertilizer was applied. Stalk N concentrations of less than 1.2% are considered N deficient and underfertilized. The N status is optimal when concentrations are between 1.2 and 2.2. Concentrations above 2.2% N are above optimal and indicate that sweet corn was overfertilized with N. An examination of the relationship between the PSNT and the ASNT found that these soil and plant tests are complementary. When soil nitrate concentrations were optimal, as measured by the PSNT early in the season, stalk nitrate concentrations were also in the optimal range at harvest. Thus, there is a low risk of sweet corn becoming N deficient when following a no-sidedress N recommendation if indicated by the PSNT. The ASNT can be used to inspire grower confidence in the PSNT.

The ASNT is also useful to sweet corn growers not using the PSNT. A survey of 37 sweet corn fields in New Jersey revealed that about half of the fields examined with the ASNT had optimal concentrations of N. In 30% of the fields the ASNT results suggested that the grower applied too little N fertilizer, and in 20% of the fields too much N fertilizer was applied. Growers will be able to use these results to adjust their N fertility practice as needed. This is expected to benefit growers with better crop yields or reduced cost of production.

Objectives

- ◆ To determine the below-optimal, optimal, and above-optimal concentrations of nitrate in the basal portion of sweet corn stalks sampled at harvest.
- ◆ To evaluate the at-harvest stalk nitrate test as an indicator of sweet corn crop N status.
- ◆ To use the ASNT to help sweet corn growers evaluate sustainable N fertility management practices such as the PSNT.

Specific Project Results

Over 60 field experiments were conducted to examine the relationship between sweet corn yield and the nitrogen status of corn stalk tissue sampled at the time of harvest. Immediately following sweet corn harvest, stalk samples were collected by cutting eight-inch segments of corn stalk from ten randomly selected plants. The tissue samples were dried and analyzed for both $\text{NO}_3\text{-N}$ and total Kjeldahl-N (% N).

The optimal stalk $\text{NO}_3\text{-N}$ concentration range appears to be between 13,000 and 15,000 ppm. When the stalk $\text{NO}_3\text{-N}$ concentration was less than 8,000 ppm, sweet corn yield was gen-

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Collaborators

Rutgers Cooperative Extension
Alstede Farms
Donaldson Farms
Johnson's Corner Farm
Walt Katna
Ort Farms
Piazza Farms & Greenhouses
Von Thun Farms
Pete Zakrewsky

SARE Grant

\$4,710

Match

\$14,321.22

Duration

1997 to 1998

Project Number

1NE96-73



erally less than 90% of maximum yield. When the stalk $\text{NO}_3\text{-N}$ concentration was above 13,000 ppm, yield was generally greater than 90% of maximum yield.

The optimal N concentration range in sweet corn stalk tissue appears to be between 1.2 and 2.2%. Corn plants with stalk N concentrations less than 1.2% generally produced less than 95% of maximum yield. Stalk N concentrations greater than 1.2% were generally associated with yields better than 90% of maximum.

The same experiments used to study stalk N status also measured the soil $\text{NO}_3\text{-N}$ concentration when the plants were eight to twelve inches tall. A critical PSNT value of 25 ppm $\text{NO}_3\text{-N}$ has been established in previously conducted research (Heckman *et al.*, 1995). PSNT soil test values of less than 25 ppm indicate that soil N supply during the growth of the sweet corn is probably not adequate and that sidedress N fertilizer should be applied. PSNT values of 25 ppm or greater indicate that the soil N supply is adequate.

The relationship between the PSNT and the at-harvest stalk N test was also examined and was found to be complementary. Although the PSNT samples were taken early in the season when the plants were six to twelve inches tall, and the at-harvest stalk N test on the day of harvest, the different tests had agreeable results. When the soil $\text{NO}_3\text{-N}$ concentration was above 25 ppm as measured by the PSNT, the stalk $\text{NO}_3\text{-N}$ and percent N values were in or above the optimal range. Thus, when the PSNT predicts that that sidedress N is not needed, the sweet corn crop clearly has enough N supply from soil to complete the growing season. In other words, following a no-sidedress N recommendation, when indicated by the PSNT, there is a low risk of later causing the crop to become N deficient.

The ASNT is also useful to sweet corn growers not using the PSNT. A survey of 37 sweet corn fields in New Jersey revealed that about half of the commercial grower fields examined with the ASNT had optimal concentrations of N. In 30% of the fields, the ASNT results suggested that the grower applied too little N fertilizer, while in 20% of the fields too much N fertilizer was applied. Growers will be able to use these results to adjust their N fertility practice as needed. This is expected to benefit growers with better crop yields or reduced cost of production.

Site Information

New Jersey sweet corn acreage is about equally split between sandy textured coastal plain soil and finer textured or loamy soils in the Piedmont. We conducted our field trials on a wide range of soils to include soil textures that are representative of where sweet corn is commonly grown. Field sites were located in Warren, Hunterdon, Somerset, Monmouth, Burlington, Middlesex, and Cumberland counties. Approximately a third of the sweet corn PSNT trials were conducted on manured land. Most sweet corn study sites were irrigated and produced useful data.

Economic Analysis

The cost of performing the at-harvest stalk tissue test is minimal. The tools required include a ruler, sharp knife, paper bag, marking pen, box to mail the samples, and postage. The samples must be sent to a laboratory capable of stalk nitrate or Kjeldahl analysis. The cost per sample is typically \$5 for nitrate analysis or \$6 for total Kjeldahl N.

Potential Contributions and Practical Applications

The major contribution of the findings from this project is that sweet corn growers have a new tool by which they can evaluate and improve their N-fertility management. At-harvest stalk tissue testing is of little value in the current season, but the knowledge gained from several years of testing should enable growers to determine if their N-fertility program is on target or needs adjustment. The ultimate benefits are expected to be improved production and more efficient use of N fertilizers.

The at-harvest stalk N test may be used along with the PSNT. The results of the at-harvest stalk tissue test may help growers gain increased confidence in the accuracy of PSNT recommendations. The benefits of the PSNT on making more efficient use of N supplied by soil and fertilizer are already well documented. Nitrogen fertilizer recommendations based on the PSNT are generally reduced about one-third, on average, compared to growers' usual practice.

Farmer Adoption and Direct Impact

Growers have become aware of the potential benefits of at-harvest stalk N testing as a result of

Cooperative Extension meetings. More growers will likely adopt the practice once the methods and interpretation are further developed and presented in the form of a fact sheet. The at-harvest N test is currently offered to New Jersey growers for free.

Rutgers Cooperative Extension collected stalk samples from 37 commercial sweet corn fields in 1997 and 1998; the results are being reported to the growers.

Recommendations

Growers who are adopting this new diagnostic practice should keep careful records of their N-fertility practices and the results of the at-harvest stalk N test for at least two or three seasons. If their stalk samples consistently do not test near the optimum range for N, they should be prepared to make appropriate adjustments in their N-fertility program.

Areas Needing Additional Study

Growers are more likely to adopt a practice if it can be made simpler and easier to perform. Procedures to evaluate sweet corn N status in the field should be investigated. Possibilities include extraction of sap from the stalk and analysis for nitrate in the field or the use of a leaf chlorophyll meter.

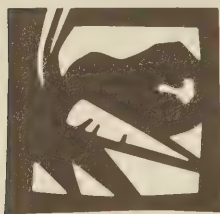
Dissemination of Findings

Project findings have been disseminated through professional meetings, grower presentations, publications, and fact sheets. These meetings and presentations have been around the northeast region as well as at the 10th anniversary SARE conference in Austin in 1998.

Reported December 1998

Project Number

LNE96-73



Developing Sustainable Management Tactics for Cucumber Beetles in Cucurbits

Coordinator

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Collaborators

Cornell University
New York farmers

SARE Grant

\$135,832

Match

\$61,296

Duration

1996 to 1998

Project number

ANE95-22

Summary

Organic growers rank cucumber beetles as the most important insect pest of cucurbits (cucumber, melon, squash, pumpkin, and others) in the US. This project is trying to develop environmentally benign and cost-effective management tactics for cucumber beetles.

Objectives

- ◆ Develop trapping techniques to control early season infestations of cucumber beetles.
- ◆ Develop cultural and biological control methods for control of cucumber beetles.
- ◆ Improve the effectiveness of botanical insecticides.

Results to Date

Fall cultivation can cause more than 40% mortality and should be done while the beetles are still active during early fall.

Of the botanical insecticides tested, rotenone at full (with and without the feeding stimulant), and half rate (with the feeding stimulant), had the lowest damage and highest beetle mortality.

The successful use of trap cropping could reduce insecticide inputs by 85%.

Method and Findings

Cucurbits are a diverse and valuable commodity grown on many farms in the Northeast and across the US. Cucumber beetles are considered a serious pest of cucurbits and growers often take a conservative approach and treat frequently with insecticides to control these pests.

This project is developing a trapping system for cucumber beetles and investigating trap crops and cultural practices to improve beetle management. Results from earlier experimental trials indicated that the use of attractant-baited traps and the use of highly preferred cucurbits as trap crops both hold potential for control of the striped cucumber beetle infestations in cucurbits. In 1998, due to inclement weather and low beetle densities, trapping trial results were inconclusive.

Studies of overwintering habits of the striped cucumber beetle showed that populations collect on remaining green vegetation and fruit where control could be targeted. Under greenhouse conditions, simulated deep burying of beetles that would result from deep tillage showed that beetles can escape even if buried 12 inches deep in the soil.

Based on our research, we would encourage more farmers to evaluate trap crops for control of the striped cucumber beetle. We would also encourage the destruction of crop residue in the fall to reduce overwintering beetle populations. Another tactic would be to scout fields in the fall once most green foliage is gone and spot-treat heavily infested fruit.

A mixture of cucurbit blossom volatiles (TIC) is an effective attractant for cucumber beetles and rootworms when used in traps, and we have improved the effectiveness of such traps through a series of 1996 studies. During the first year of this SARE-supported project we investigated several types of traps, including a design that only requires beetles to land on the trap. There, the beetles pick up a small dose of toxicant or spores of an insect pathogen. This design would result in rapid control from the toxicant adhering to the beetle or slower control via infection by the pathogen. Thus it should be possible to mass trap beetles using an extremely small amount of toxicant, which never



contacts the crop, and then remove the toxicant from the field for disposal elsewhere. This method could considerably reduce the amount of insecticide used for managing cucumber beetles.

For organic growers, the synthetic toxicant could be replaced with one appropriate for their needs. However, earlier trials showed that the traditional insecticides most often used by organic growers were only marginally effective when used in traps. Although slower in rate of control, pathogen-containing traps may be best for organic systems.

Initial studies under field cages on the potential of these traps in 1996, and subsequent elaborate trials in 1997 under field conditions, gave promising results. We further tested the effectiveness of mass trapping twice during the summer of 1998. We did not find any significant difference in the number of beetles per plant or injury rating during either trial. Frequent heavy rainfall during the early season trials may have washed away the toxicant on the trap and also reduced the effectiveness of the TIC, thereby reducing the effectiveness of the traps. We have demonstrated that this tactic is effective, but now need to modify the trap to make it more durable and able to remain effective under adverse environmental conditions. Results from late season trials were inconclusive because of low beetle densities.

In addition, we set up three TIC baited traps during the fall in a pumpkin field at Whitney Point, New York to determine whether these traps could be installed in the fall to control the beetle population that winters over. Results from this study suggest that the use of traps in the fall and when cucurbit vegetation has been greatly reduced holds considerable promise.

Cucumber beetle management can also be improved through the development of cultural and biological control tactics. Certain types of cucurbits are highly preferred by cucumber beetles, and these preferred types could aggregate beetles and their progeny for more efficient control.

The results of our 1996 and 1997 experiments showed that highly preferred cucurbits in combination with TIC traps is effective in reducing striped cucumber beetle numbers and injury. In 1998, we conducted trials on three farms to demonstrate the trap cropping technique. A highly preferred squash type (Seneca zucchini) was used as trap crop while

the main crop was either pumpkin or squash. Unfortunately, all the growers applied insecticides upon the first arrival of beetles and therefore the effect of trap cropping on the protected crop could not be observed on any of these demonstration plots.

The successful use of trap cropping could reduce insecticide inputs by 85% because only the trap crop, about 15% of the field, would be treated. The tactics will be of particular value to organic growers, whose options at present are limited. Also, the mass-trapping could reduce insecticide input since only a very small quantity of insecticide is being used.

In addition to trap cropping, cultural practices such as fall cultivation may affect survival of overwintering cucumber beetles. The beetles present in the field late in the summer and fall infest fields the following spring. Our objective was to monitor the fall population of beetles and also to study the effect of fall cultivation and fall clean-up on the beetle mortality.

Beetle activity during the fall and into winter was monitored in four fields. Ten sticky cards were placed at random in the fields; sticky cards were also installed around the edge of each field to monitor the dispersal of beetles away from the field to overwintering sites.

During late September, when the plants were still green, the beetles were found throughout the field. As the fall season progressed the leaves started drying, leaving only a few green patches for the beetles to aggregate around. After the first frost there was limited green vegetation and the beetles moved to decayed, damaged, and undamaged fruit in the field. The beetle count in the field started decreasing in the fourth week of October. This indicates that the fall cultivation should be done while the beetles are still active—waiting too long may result in beetles leaving the field or burying themselves deep in the soil to survive.

Low levels of beetles late in the season prevented us from testing cultivation equipment as planned, but simulated field and greenhouse cultivation trials are taking place this winter.

A complementary experiment was set up under greenhouse conditions to simulate late summer or early fall deep cultivation, but under conditions of warm weather while the plants are

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ANE95-22

still green and beetles still active. Results show that 58% and 61% of beetles that were buried six and twelve inches were able to crawl up to the soil surface and survive. However, none of the beetles that were buried at the 18-inch depth made it to the surface. Fall cultivation can cause mortality in excess of 40%, and should help reduce overwintering populations.

Suppression of immature cucumber beetles with entomopathogenic nematodes appears possible and could be especially effective if applied to trap crop plants to control progeny of aggregated adults. Unfortunately, the commercial nematode industry has dwindled drastically since this project started and we have not been able to obtain commercial formulations of the nematode species that we intended to test. Complimentary research has discovered two species of striped cucumber beetle parasitoid species not previously recorded in this region. This new biological control information indicated higher rates of parasitism than anticipated and promise of enhancement of these parasitoids for biological control, thereby reducing the use of insecticides.

Results of the 1997 experiments showed that all the botanicals tested caused a reduction in beetle damage. Rotenone at full (with and without the feeding stimulant), and half rate (with the feeding stimulant), had the lowest damage and highest beetle mortality. The addition of the feeding stimulant permitted a halving of the rate of rotenone

without a significant reduction in the effectiveness. However, feeding stimulants did not improve the effectiveness of cryolite. Neem did not have any significant effect on the beetle survival or mortality but, being an antifeedant, it significantly reduced damage caused by beetles to plants.

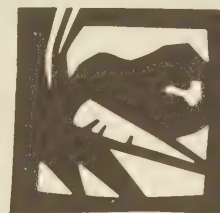
Economic Analysis

The trap cropping and use of TIC traps have been found to be relatively effective against adult striped cucumber beetles. The use of trap cropping would be more feasible for small growers who normally plant many varieties of cucurbits on their farm. The cost involved should be minimal because all that is involved is rearranging specific crops (preferred and nonpreferred), which most plant anyway. Likewise, the cost involved in fall cultivation should also be minimal. Most farmers cultivate during late fall; advancing the time of cultivation would help in control overwintering populations at almost no additional cost.

The mass trapping method would cost about \$23.60 per acre at 40 traps per acre. There would be an additional cost related to labor for trap installation. A single insecticide application costs about \$19 an acre; however, it is not unusual for growers to apply more than one application for cucumber beetles. If traps were produced in large numbers, then the unit cost would decrease considerably. This would make the traps more competitive with the cost of a single insecticide treatment.

Reported December, 1998

Working towards Implementation of a Disease Forecasting System for Fresh Market Tomatoes in Northern New Jersey



Summary

This project has been directed at developing a viable approach to disease forecasting even under heavy and diverse disease pressures. The 1997 research confirmed that important fungal diseases affecting New Jersey's tomatoes can be controlled, and marketable yields sustained, while fungicides are reduced dramatically.

The premise behind disease forecasting is that fungicides can be applied as needed, when disease development is likely, rather than being applied according to the calendar. Using forecasting methods reduced production costs for growers and the environment benefits from reduced pesticide use. This project continues to evaluate and develop the use of the TOM-CAST system for forecasting tomato diseases in northern New Jersey.

Objectives

- ◆ Continue evaluations of tomato disease forecasting as an alternative approach to disease control for fresh market tomato production in northern New Jersey by conducting field research to specify thresholds for using the TOM-CAST system under different seasonal weather conditions, by evaluating the impact of reduced fungicide applications with TOM-CAST on postharvest fruit quality, and by expanding the database for evaluating the economic impact on tomato production of using (TOM-CAST) as an alternative approach to disease control.
- ◆ Continue to develop the software required for weather data collection and forecast generation, evaluate weather monitoring equipment, and standardize equipment use procedures.
- ◆ Continue to investigate an electronic meteorological service as an alternative to on-site weather monitoring.
- ◆ Continue grower research demonstrations, and continue to explore means for delivery of disease forecasts.
- ◆ Generate the information, including the economic data, needed to determine how disease forecasting might best be implemented by individual growers or provided by organizations such as grower cooperatives or by programs such as Rutgers Vegetable IPM program.

Abstract

The use of forecasting for tomato disease control in northern New Jersey has been under evaluation since 1991. The basic premise behind disease forecasting in crop production is that fungicides are applied as needed, when disease development is likely, rather than by conventional calendar-based scheduling. This allows for potential reductions of chemical inputs while maintaining crop quality and yields. The potential benefit to growers is lower production costs; the benefit to the environment is reduced pesticide applications during crop production and reduced potential for environmental pollution.

The TOM-CAST forecast system was shown to have important advantages over other systems, in that it was more user friendly and maximized reductions in spray schedules while providing adequate disease control. The 1998 SARE/ACE research trial, conducted at the Rutgers Snyder Research and Extension Farm, focused on evaluating fungicides and combinations of fungicides in

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Collaborators

New Jersey Farmers
Rutgers University

SARE & ACE Grants

\$54,210

Match

\$114,730

Duration

1996 to 1998

Project Numbers

LNE95-59 and ANE96-30

NJ

Project Numbers

LNE95-59 and ANE96-30

conjunction with TOM-CAST using the decision thresholds defined during trials in previous years. All evaluated fungicides reduced foliar disease, whether on a weekly or TOM-CAST schedule. Control with the TOM-CAST schedule was somewhat less than with the weekly schedule. Quadris, azoxystrobin, a relatively new fungicide chemistry, used in alternation with Bravo Weatherstik, chlorothalonil, a widely used fungicide, provided the best disease control on both a weekly or TOM-CAST schedule. NuCop 3L was least effective with the TOM-CAST schedule. Five TOM-CAST scheduled applications resulted in total and marketable yields statistically equivalent to yields resulting with 15 conventionally scheduled applications for all fungicides except Champ 2F.

Under research trial conditions of high disease pressure from a new, powdery tomato mildew, most materials controlled disease adequately with TOM-CAST schedules that reduced the number of sprays by 67%. The 1998 research trial confirmed that disease forecasting is a sustainable alternative approach to disease management in tomato production. By following TOM-CAST during the 1998 season, 22.5 lb per acre of fungicide active ingredient (assuming use of Bravo Weatherstik at 3 pts per acre per spray) could have been eliminated from tomato production.

Disease forecasts were available to tomato growers in northwestern New Jersey in 1998. Over 50 growers were instructed on the use of TOM-CAST at the North Jersey Vegetable Growers Meeting in February 1998. Printed information was also distributed. During 1998, thirteen growers received TOM-CAST forecasts by fax or from IPM scouts.

In 1997, data from six on-site weather stations was compared with data from SkyBit, an electronic meteorological service, for the same sites. This comparative research was replicated in 1998. In 1997, SkyBit data generally provided a more conservative TOM-CAST forecast than did on-site data due to differences in both leaf wetness and temperature. Data variation has been attributed to consistent errors in the systems, to some random error, and to specific conditions at a given site. TOM-CAST is not very sensitive to inputs, which increases the potential for electronic weather data being useful in this system. The use of weather data from a subscription service would eliminate the need for forecast providers to buy and maintain weather stations

and the computer systems needed to access them. It would also make do-it-yourself forecasting affordable and feasible for growers. Analysis of the 1998 data will clarify whether or not an electronic weather service will be a viable source of weather information for TOM-CAST.

Specific Project Results

A field trial at the Snyder Research and Extension Farm evaluated various fungicides and combinations of fungicides with TOM-CAST using decision thresholds defined in previous research trials. Weather data for generating the TOM-CAST forecast was obtained from an on-site field monitor from sensor instruments, the same equipment used at grower sites. Bravo Weatherstik (3 pt. per acre), Quadris alternating with Bravo (0.6 oz or 3 pt. per acre), Champ 2F (1.5 to 2.5 pt. per acre), Champ 2F and Bravo Weatherstik (1.5 pt. per acre of each), NuCop 3L (1.5 to 2.5 pt. per acre), NuCop and Bravo Weatherstik (1.5 pints per acre) or Manzate 200DF then Bravo 720 (3 lb, 3 pt. per acre) were applied on weekly or TOM-CAST schedules. Foliar disease was visually rated each week beginning in mid-August when foliar damage was first observed. Fruit was harvested weekly and total and marketable weight recorded.

Disease incidence was heavy throughout the field by the end of the season, with the most prevalent foliar diseases being early blight, the most serious foliar fungal disease of tomatoes in New Jersey, and a powdery mildew. The weekly schedule resulted in 15 applications; the TOM-CAST schedule called for five applications. Disease ratings on September 23 indicated that all fungicide treatments reduced foliar disease compared to the untreated control. Quadris alternating with Bravo on the weekly or TOM-CAST schedule was better than any other treatment. Control with the TOM-CAST schedule was somewhat less than with the weekly schedule for all fungicide treatments. NuCop 3L was least effective with the TOM-CAST schedule. Total yields were not affected by fungicide or schedule. No fungicide treatment increased marketable yields compared to the control. Marketable yield was not affected by schedule for any fungicide except Champ 2F. Weekly applications of Champ 2F or NuCop-Cop 3L actually reduced marketable yields.

The 1998 trial provided important evidence, expanding on that from previous years, that disease

forecasting is a viable approach to disease control. In the presence of powdery mildew, a new disease on field tomatoes in New Jersey, the TOM-CAST schedule provided enough control to maintain marketable yields. Reducing the number of fungicide applications by almost 70% would benefit growers through reduced costs, and would benefit the environment through reduced chemical inputs.

A procedure for calibrating and monitoring on-site weather equipment, begun in 1997, was continued in 1998.

The 1997 comparison between on-site field monitor data and data obtained through subscription to the electronic meteorological service, SkyBit, Inc., found that SkyBit temperature readings were lower on average at all sites. Leaf wetness readings were in agreement two-thirds of the time, but totals were lower at most sites. SkyBit data generally provided a more conservative TOM-CAST forecast than did on-site data due to the differences in both leaf wetness and temperature. Analysis of the 1998 weather data from these sources for the same sites will clarify whether an electronic weather service will be a viable source of weather information for TOM-CAST.

The grower-demonstration component of the project was eliminated in 1997 when the decision was made to offer TOM-CAST forecasts to the tomato growers in northwestern New Jersey. In 1998, six field monitors were deployed in an area of approximately 400 square miles to collect weather data needed for TOM-CAST. Forecast information was updated twice weekly from May 1 to October 15 and provided to growers by an AT&T Digital Answering System and by fax on request. In 1998, TOM-CAST forecast information was also available through the Rutgers Fax Info Line and as part of the Rutgers Cooperative Extension Vegetable IPM Tomato Program. Fifty growers were instructed in the use of TOM-CAST at the North Jersey Vegetable Growers Meeting in February 1998.

Of 21 surveys sent to growers who received training instruction and information on TOM-CAST in 1997, 15 were returned. Ten growers did not use TOM-CAST in 1997 for a variety of reasons including crop failure, small acreage, no on-farm weather station, inconvenient phone-in, laziness, and lack of information. Of the five growers using TOM-CAST, three provided actual spray records indicating they made 52% fewer sprays as compared to a conven-

tional seven-to-ten-day schedule. Resulting cost savings were estimated at \$295 per acre. Chemical inputs were reduced by an average 15.75 lb. per acre, assuming use of chlorothalonil at 2.25 lb. active ingredient per acre per spray.

A survey mailed to growers in late 1998 will clarify the economic and practical advantages and disadvantages of using disease forecasting in commercial tomato production. The estimated costs of Rutgers Cooperative Extension providing forecasts to growers in 1997 were presented at a discussion of vegetable integrated pest management on December 16, 1997.

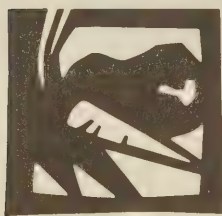
Dissemination of Findings

The 1997 grower survey results were presented at the New Jersey Vegetable Growers Meeting, January 21, 1998, in Atlantic City, at the North Jersey Vegetable Growers Meeting, February 9, 1998, in Pittstown, New Jersey, and at the 1998 International Conference of the American Society of Horticultural Science, July 11 to 15, in Charlotte, North Carolina. During 1998, information about TOM-CAST and forecast summaries were published in Rutgers Cooperative Extension Plant and Pest Advisory Newsletter, which is disseminated statewide. The 1998 research trial was discussed at the North Jersey Research Results Twilight Meeting, September 2, 1998, and the results presented at the Annual Mid-Atlantic Vegetable Workers Conference, November 3 and 4, in Newark, Delaware. Written reports will be submitted to that proceedings and for publication in APS' Fungicide and Nematicide Tests, Volume 54, and to Vegetable Plant Pathology Research Results Report, Rutgers Research and Development Center, Bridgeton. Reports and summaries will be posted on the SARE Tomato World Wide Web page at <http://www.virtualorchard.net/tomato/> as downloadable PDF files and as html files. A manuscript will be prepared during 1999 for submission to a refereed journal.

Reported December 1998

Project Numbers

LNE95-59 and ANE96-30



Integrating New Cultivation Technology & Photocontrol of Weeds to Reduce Herbicide Use in Vegetables

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Collaborators

Cornell University
New York farmers

SARE Grant

\$91,546

Match

\$133,128

Duration

1995 to 1998

Project number

1NE94-40

Key Findings

Cultivation can replace herbicides in short-season vegetable crops such as transplanted broccoli and snap beans, and can supplement banded herbicides in sweet corn and potatoes. However, environmental conditions, particularly precipitation, can have a severe negative impact on the timeliness and eventual success of cultivation, and can significantly increase a grower's economic risks.

Growers who intend to rely on cultivation for the majority of their weed control, must cultivate the first time *before the weeds even appear* (preemergence cultivation).

With longer season crops, growers must be prepared to use strategies other than or in addition to cultivation if yield reductions are to be avoided. Hand weeding may be cost-effective in fresh market vegetable production; it is cost-prohibitive in processing vegetable production.

Timeliness is of the essence, whether with the first cultivation event or a later one. If cultivation is missed at the appropriate time, yield reductions are almost guaranteed.

Growers are best served if they have the potential to be flexible, having different types of cultivation tools for different stages of crop growth and herbicides for use on an as-needed basis.

Objectives

- ◆ To determine the feasibility of use and limitations of different types of cultivation implements in snap beans, transplanted broccoli, potatoes, beets, and sweet corn.
- ◆ To determine the effect of weed growth stage on selectivity to flex-time implements.
- ◆ To investigate the potential for the photocontrol of weeds common to northeastern agricultural fields.

Methods and Findings

After three years of cultivation trials in transplanted broccoli, snap beans, sweet corn, and potatoes research for this project has been completed. The flex-time cultivators, used once and followed by an inter-row cultivation, were able to replace herbicides. While two cultivations could also provide adequate weed control in a mid-season crop such as snap beans, untimely precipitation can cause cultivation failure resulting in reduced yields.

In a long-season crop like potatoes, cultivation alone can also result in yields equal to those with the use of broadcast herbicides, though weed control is less effective. Greater weed populations may reduce potato yields in years of low precipitation or produce large amounts of weed seeds that cause severe weed infestations in subsequent crops. For these reasons, the use of banded herbicides and inter-row cultivation in snap beans and potatoes provides the least risk and greatest economic returns to growers.

Sweet corn, a long-season crop, cannot compete effectively with weeds early in the growing season; therefore, cultivation must be supplemented with banded herbicides. Expected herbicide reduc-



tions with banded applications would be 1.25, 6.25, 1.67, and 2.5 lb ai/A for broccoli, snap beans, potatoes, and sweet corn, respectively.

Initial analysis of cost of production data from sweet corn and snap bean grower surveys indicate that cultivation combined with banded herbicides could reduce weed control costs at least \$15/A and \$6/A in snap beans and sweet corn, respectively, without a reduction in yield.

Research trials and experimentation by growers indicate that, to be effective, the flex-tine harrows must be used when weeds are at the two-leaf stage or smaller. The currently available cultivator models are also limited in that they are not appropriate in size for all crop row spacings and/or cannot be easily adjusted, particularly in wet soils. Overall, it is expected that for long-term economic viability, growers will face less risk if they are flexible and are equipped to use both cultivation and herbicides on an as-needed basis. Attempts to employ cultivation in the dark or with shielded implements (photocontrol) have met with variable success. Though in some instances weed emergence can be reduced by as much as 50%, the practical significance of photocontrol has yet to be determined.

A fact sheet for distribution to extension agents and growers was published and more detailed research results will be available shortly in the annual publication, "Cornell Vegetable Weed Science Research Results."

Farmer Feedback on Cultivators

In 1997, four growers had an opportunity to use the brush hoe and the flex-tine harrows in a variety of vegetable crops and strawberries. The growers found the flex-tine harrows to be effective in a number of crops, including potatoes, carrots, snap beans, sweet corn, and strawberries. These tools did cause significant crop injury and stand reduction, however, depending upon the crop (even crop variety) and stage of crop development.

Additional limitations mentioned by all growers were the size and lack of adjustment of the implements. The width of the cultivators works well with the 30-inch row spacing used at the research farm, but many growers use other spacings and/or a variety of row arrangements. With some row spacings, growers found it necessary to overlap passes with the cultivator to achieve adequate weed control, thereby increasing the time required and the cost of cultivation. In some situations, the cultivators could not be used without damaging one or several crop rows.

The current design of these implements makes it difficult if not impossible to adjust to all row arrangements. Simply increasing the width of the implements could overcome some of these difficulties, while other problems would require redesigning certain features of the tools. Nevertheless, grower experience suggests that the currently available cultivators can provide satisfactory weed control after determining where their use is most appropriate. Equipment dealers have realized that there is a new market for cultivation tools and have taken steps to bring in some of the types being sold in Europe.

Reported December 1997

Project number

LNE94-40



Management Strategies for Improved Soil Quality with Emphasis on Soil Compaction

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Collaborators

Cornell University and Cooperative
Extension
New York vegetable growers

SARE Grant

\$130,000

Match

\$378,755

Duration

1995-1998

Project number

LNE94-44

Summary

Soil compaction is a common problem in many northeast vegetable farms because wet soil conditions frequently exist when farmers must enter the field with heavy equipment. Soil compaction can reduce yields of vegetable crops by 30% to 70%. Secondary effects of compaction, such as prolonged flooding and severe insect and weed pressure, contribute to yield losses, and can also result in increased use of pesticides for control of disease, insects and weeds. However, few farmers have evaluated crop-rotation options or the full arsenal of cover-crop species for their potential to prevent or remediate poor quality or compacted soils.

This project identified specific soil management practices that reduce root disease and soil-borne pathogen pressure. These include mechanical remediation procedures such as deep tillage or subsoiling and frost tillage, and bioremediation methods such as the use of cover crops, compost, and specific rotation sequences.

Objectives

- ◆ Evaluate several winter cover crops, rotation crops, and cropping sequences for their effect on soil quality and soil compaction.
- ◆ Identify and integrate effective mechanical procedures for remediation of compaction with bioremediation approaches.
- ◆ Quantify the relationship between soil management practices and the occurrence of soil-borne pathogens and severity of root disease.

Key Findings

Sudan grass as a summer crop and perennial ryegrass as a fall or winter crop ranked highest among the 14 cover crops we evaluated with regard to remediation of soil compaction, ease of crop establishment, and year-to-year and site-to-site stability of performance.

Results suggest that including sweet corn and sudan grass in the rotation sequence may enhance or prolong the beneficial effects of a deep tillage operation on soil quality parameters, and may make the soil less susceptible to compaction.

Direct-seeded cabbage and snap beans were the crops most negatively affected by compaction, followed by cucumber, table beets, sweet corn and transplanted cabbage.

Activities and Results

Compaction is a common problem in vegetable production systems in the Northeast because farm operations sometimes require entering the field before the soil has adequately dried. Deep tillage to break up deeper compacted layers requires powerful tractors that are not available to some growers. Those who do try deep tillage find it is not a very effective solution, especially in the long term. Taking land out of vegetable production for two to three years in order to grow alfalfa, a known deep-rooted perennial, can be effective, but this is not an economically viable option for most vegetable farmers. Also, it can sometimes be difficult to establish a healthy alfalfa crop on compacted soils.

A three-year multi-site field study was conducted to evaluate various cover crops, rotation cycles,



compost, and deep tillage for their impact on soil compaction, soil quality, the soil pests and diseases, and cash crop yield. Mechanical deep tillage of 12 to 16 inches on compacted sites had significant beneficial effects on soil quality parameters in the first year. Soil penetrometer resistance and bulk density were lower on deep-tilled compared to non deep-tilled plots. Porosity, water infiltration rate, time-to-ponding, and water holding capacity were significantly increased by deep tillage.

Effect on Crops

Direct-seeded cabbage and snap beans were the crops most negatively affected by compaction, followed by cucumber, table beets, sweet corn and transplanted cabbage. Yield response to compaction in the field is often associated with crop sensitivity to secondary effects of compaction, such as prolonged flooding after rainfall, reduced nutrient availability or uptake, and prolonged or more severe insect, disease, or weed pressure. Not surprisingly, deep tillage of compacted sites led to 10% to 70% increases in crop yields in the first summer after tillage.

Part of the benefit of deep tillage on snap bean yields was associated with less root disease. Of the five cash crops that we evaluated, sweet corn was best at producing roots that could penetrate into compacted soil layers. Sweet corn often produced substantial biomass on compacted soils, even when ear yields were reduced. These results suggest that sweet corn can be a good rotation crop to include on fields with shallow compacted layers, although it was not as beneficial as some non-cash cover crops evaluated.

Cover Crop Evaluation

Sudan grass as a summer crop and perennial ryegrass as a fall or winter crop ranked highest among the 14 cover crops we evaluated with regard to remediation of soil compaction, ease of crop establishment, and year-to-year and site-to-site stability of performance. Sudan grass had the deepest root system and generally ranked highest for root growth into compacted soil layers. Sudan grass also ranked high with regard to organic matter contribution, weed suppression, and suppression of parasitic nematodes and root disease of subsequent snap bean crops. Hubam sweet clover was another cover crop that consistently performed

well, including growth on compacted soils. However, Hubam did not produce as much below-ground biomass as sudan grass or perennial ryegrass. Yellow blossom sweet clover, grown as a two-year crop, produces deep roots, but we did not have an opportunity to fully evaluate its performance on a compacted soil in our trials.

Grain rye, hairy vetch, and grain rye-plus-vetch mixtures are fall cover crops that frequently performed well, but they were not particularly effective at compaction remediation. Also, hairy vetch did not grow well on poorly drained, compacted soils, did not overwinter in some trials, and was associated with higher populations of parasitic root lesion nematodes in subsequent bean crops. Our results indicated that yellow mustard and other cover crops in the *Brassica* genus are potential soil compaction remediators because they produce deep, penetrating taproots. However, we encountered some problems in establishing a good stand in some sites in some years. More research is needed to determine optimum management practices under northeast conditions for all of these cover crops.

Soil Management and Rotation

Table beets responded very positively to addition of a composted chicken manure applied at rates between 2 and 5 tons per acre. Snap bean and sweet corn response to this compost was more variable, slightly increasing yields at one site, while having little effect or even a negative effect on sweet corn at the other site.

Our results indicated that bean monoculture without rotation to other cash or cover crops led to a decline in yield associated with an increase in root disease severity. Our data also suggested that rotation, particularly sequences that included sweet corn and sudan grass, enhanced and prolonged the beneficial effects of deep tillage on both the physical and biological properties of the soil.

Affect on the Soil Pest Complex

Root diseases caused by fungal and nematodal pathogens reduce yields of many economically important vegetable crops of New York and the Northeast. Damage by root diseases is most severe on poor soils, such as compacted soils with poor structure and inadequate drainage, soils low in organic matter, and soils with low nutrient availability.

Increasing soil organic matter through the use of cover crops and green manures is well documented to improve soil physical and chemical properties, and also is known to increase the number and diversity of the total soil microbial community. The latter results in direct suppression of root pathogens and the production of bigger and more vigorous root systems that are tolerant to damage by root pathogens.

Our results have shown that the use of cover crops is generally beneficial in increasing yield and reducing root disease severity and crop damage. Bean monoculture without rotation to sweet corn or other cash or cover crops led to a decline in yield associated with an increase in root disease severity. Our results also documented that the various rotation cover crops are not equal in their impact in suppressing root diseases or the population of individual pathogens.

Frost Tillage as a Soil Management Option

Frost tillage is a primary tillage method that may be performed when a thin (1-to-4-inch) frozen layer exists at the soil surface. When frost enters initially unfrozen soil, the freezing-induced water redistribution causes soil drying below the frost layer and may therefore allow for tillage. A multiyear analysis of frost tillage demonstrated that this may be an attractive management alternative for vegetable growers in the Northeast, especially for early-season crops on medium- to fine-textured soils. Frost tillage allows spring field work to be performed during the winter and facilitates soil drying in the spring, thereby potentially reducing soil compaction from early field work. Using model simulations based on climate data from the Northeast, frost tillage opportunities occur most often (four to five days in the average per winter season)

at the 40- to 43-degree latitude, with generally lower number of frost-tillable days to the north and south of this belt.

Specific Crops

Cabbage

Direct-seeded cabbage was the most sensitive to soil compaction of all vegetable crops evaluated in our trials. A key factor in these yield reductions was more severe flea beetle pressure and damage during early growth stages in compacted plots. Cabbage seedlings grew much more slowly on compacted soil, prolonging the period when they are most subject to significant flea beetle damage. Weed competition was also more severe early in the season on compacted compared to non-compacted plots. Another factor causing yield reduction in compacted plots was stunted growth following periods of heavy rain because of poor drainage and a prolonged period of saturated soil conditions.

Transplanted cabbage was less sensitive to compaction than direct-seeded cabbage. Transplanted cabbage plants, because they essentially bypassed the early seedling stage in the field, were less affected by flea beetle damage and weed pressure early in the season compared to direct-seeded cabbage. Another factor may be that, in general, transplanted crops tend to have more prolific rooting of fibrous roots in the upper soil profile than direct-seeded crops. Location of the compacted zone, rainfall and irrigation patterns during the season, and ability of taproots to penetrate a compacted layer may determine whether the shallow rooting of transplants or deeper rooting of a direct-seeded crop is advantageous on compacted soil.

Snap beans

Snap beans ranked second to direct-seeded cabbage in yield sensitivity to soil compaction. One important factor involved in yield reductions on compacted plots was prolonged stunted growth after heavy rains due to poor drainage and extended periods of wet soil conditions, as was also observed for cabbage. Results of leaf tissue testing during the growing season revealed some nitrogen deficiency in compacted plots, which may also have been a yield-determining factor.

Results have generally shown that bean yields are increased and root rot is reduced after the incorporation of a green manure of grain crops such as oat, ryegrass, grain rye, barley, wheat, sudan grass, and others. Obtaining the benefit from cover crops in a bean rotation requires proper management of the cover crop. In particular, it is important to leave enough time, usually three to four weeks, between incorporation of the cover crop and seeding the beans to allow for decomposition to occur.

Sweet corn

As compared with beets, cabbage, snap beans and cucumber, sweet corn was less negatively affected by soil compaction in some sites in some years, although yields can still be reduced by 50% or more.

Reported April 1998

Project number

LNE94-44



Demonstrations of Sustainable Vegetable Pest & Crop Management: Fresh Market Sweet Corn

Coordinator

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Collaborators

Central New York Crop Management
Association
Cornell University & Cooperative
Extension
New York farmers
New York State Agricultural
Experiment Station
Wegmans Food & Pharmacy

SARE Grant

\$164,356

Match

\$99,171

Duration

1997 to 2001

Project number

LNE96-67

Summary

The overall goal of this project is the education of farmers, Cooperative Extension specialists, extension agents, agribusiness leaders, and consumers about the need to adopt sustainable integrated pest management and integrated crop management (IPM/ICM) techniques. It is focused on fresh market sweet corn for the proposal period, but is part of an ongoing effort that includes all vegetables. This phase defined four sweet corn pest and crop management systems (organic, IPM/present, IPM/future, and conventional) and implemented them on grower farms and on a university research farm.

Objectives

- ◆ To demonstrate to farmers, extension specialists, extension agents, and agribusiness leaders the economic and environmental benefits of adopting IPM/ICM techniques as part of a more sustainable approach to vegetable production.
- ◆ To conduct one demonstration site to compare all defined pest management systems for fresh market sweet corn.
- ◆ To collect and evaluate pest, pesticide use, economic, environmental impact, yield, and quality data to compare the systems at the farm sites and the university site.
- ◆ To publicize the results of the comparisons through field days, presentations at grower meetings, and conventional and electronic publications.
- ◆ To work with a major supermarket and its growers to implement sustainable practices for fresh market sweet corn, and to identify the corn to consumers as produced using IPM/ICM practices.

Results to Date

Fifteen growers participated in documenting IPM practices and in many cases have reduced pesticide use.

Generally, the conventional and IPM systems were the most profitable while the organic system showed the least environmental impact. Adoption of IPM techniques have the potential to keep growers at least as profitable as they are using conventional techniques.

Atrazine rates have been reduced by about 60%.

These IPM management systems will reduce overall pesticide use by 56% to 84% when compared to conventional practices.

An IPM educational video was produced by Wegmans supermarkets and shown on local television and in stores.

Methods and Findings

Several differences in system definitions between the first two objectives occurred for logistical reasons. In most cases, the differences occurred as a result of grower decisions on management practices over which the investigators had no control. In general, cooperators experienced weather conditions that prevented implementation of the weed and rotational aspects of the systems. Therefore, systems in grower fields were limited to the definitions for insect and disease management.



IPM present and IPM conventional systems were demonstrated on three farms. Harvest quality was excellent in all fields, and low European corn borer (ECB) pressure during the second-generation flight allowed growers to save, on average, one or two insecticide applications.

In grower fields, the IPM future insect management strategy was modified to include using *Trichogramma ostriniae* and *Bacillus thuringiensis* (Bt) for ECB management. Pheromone traps for ECB, corn earworm (CEW) and fall armyworm (FAW) were placed near each field to help determine optimal release times for the *Trichogramma* and the most effective Bt product. Commercially acceptable control was achieved in all of the IPM future fields. Low ECB pressure during the second-generation flight made it difficult to assess parasitism levels.

The organic system was implemented at two farms. At the Porter farm, weeds were a limiting factor due to heavy rains that prevented timely cultivation. The second planting was disked down due to weed pressure.

At the Martens farm, a 25-acre field of organic processing sweet corn was identified as a *Trichogramma ostriniae* release candidate in June. Timely cultivation was possible, resulting in good weed control. Yield was five tons per acre of sweet corn, with approximately two tons lost to lodging two weeks prior to harvest, for an estimated yield potential of seven tons per acre. This yield compares favorably to conventional sweet corn yields this season, which averaged five to seven tons per acre across the state.

Trichogramma ostriniae were released in both organic fields. As occurred with the IPM future treatments, second generation ECB pressure was low, making evaluation of parasitism levels difficult. ECB infestation at harvest was low in both organic fields.

Corn earworm infestation has been a consistent cause of loss in the late planted organic system for the three previous years. In 1998 we added the Zea Later to the organic system. Large reductions in damage from CEW were observed in 1998 compared to the other years in the trial. Cost for the Zea Later treatment was similar to two or three spray treatments on a small acreage.

IPM elements have been defined for fresh market sweet corn. Each element has been as-

signed a point value depending on whether it is thought to be more or less important to the practice of IPM. Growers in the labeling effort have kept documentation of the practice, or lack of practice, for each element. The points have been totaled; to be labeled as IPM-grown, a field must achieve at least 80% of the points available. A survey of 206 fresh market sweet corn growers conducted by the New York Agricultural Statistics Service in 1995 indicated that most growers were achieving between 40% and 70% of the IPM element points. The 30 growers participating in this project all achieved at least 80% of the points available with some fields reaching 100%.

Surveys revealed the profile of the typical farm growing sweet corn contains 275 production acres—100 acres are planted to field crops, 100 acres to other vegetables, and 75 acres to sweet corn. This farm grows ten different crops. The acres covered per year and hours of use for each implement are based on all 275 acres in crop production.

Potential Impacts

Continued adoption of IPM and organic practices described in these systems have the potential to reduce environmental impact as measured by the environmental index of quality by at least 50% based on the first years' results.

To make *Trichogramma* releases economically feasible, Bt materials should be used to kill ECB larvae that are present when the *Trichogramma* releases begin.

The Zea Later method of controlling CEW for late organic corn has potential for small acreages on farms that do not own sprayers, and perhaps for larger farms if labor is available.

Pesticide use reduction

By banding herbicides in a ten-inch band over the row and subsequently using the routine cultivation and sidedress operation to control weeds between the row, we have reduced Atrazine rates by about 60%. On 30,000 acres of fresh market sweet corn in New York, adoption of this technique could result in a reduction of about 20,000 pounds of Atrazine.

Lannate (methomyl), Furadan (carbofuran), Lorsban (chlorpyrifos), Baythroid (cyfluthrin),

Project number

LNE96-67

Project number

LNE96-67

Asana (esfenvalerate), Warrior (lambda-cyhalothrin), PennCapM (methyl parathion), Ambush/Pounce (permethrin), and Larvin (thiodi carb) are used to eliminate European corn borer, corn earworm and fall armyworm. If scouting and thresholds are more widely adopted, then use of these insecticides would be reduced to varying degrees depending on individual growers' current

practices and insect pressure in a given year. If the use of *Trichogramma ostrinae* supplemented by Bt materials becomes widespread, then the use of these insecticides could be eliminated for early corn in upstate New York until the time corn earworm migrates into the state, usually in late August or early September.

Reported December 1998

Biological & Cultural Methods of Insect Management in Vegetables: Conference & Publication of Proceedings



Summary

By the end of the first year of this two-year project, we have held an information exchange for farmers and scientists on alternatives to using insecticides for managing vegetable insects. By design, this exchange brought together a small group: farmers who had information to share from participation in research projects or from their own observations and experimentation, farm advisors with particular interests in alternatives to insecticides, and scientists whose work focuses on these topics identified by farmers.

The exchange address both general principles and the management of specific crops; small groups also addressed the potato leafhopper and the tarnished plant bug, two insect pests that move among crop species.

Each of the workshops included presentations by scientists, farmers, and farm advisors, and ample time was reserved for questions, ideas, problems, and issues. The atmosphere was frank and informal, and creative, cooperative thinking flourished. All workshops were recorded with audio tape and written notes.

A book of the proceedings of the information exchange will be produced next year, based on audio and written records of the workshops and a written summary of each presentation by the presenter. This book will be the vehicle for presenting the alternatives to insecticides for managing insects in vegetables to a larger audience of farmers, farm advisors, and scientists.

Objectives

- ◆ To bring together a small group of farmers and scientists in an exchange of research results, ideas, and questions about biological and cultural methods of insect management in vegetables.
- ◆ To make the information exchanged available to farmers, farm advisors, researchers and others in book form.

Specific Results

The exchange on alternatives to insecticides for managing vegetable insects met on December 5 and 6, 1998, in New Haven, Connecticut. Potential contributors were identified using lists of SARE farmer research projects, participants from a previous conference in Massachusetts, and from contacts with organic farming organizations. In the invitation to the exchange, farmers were asked what information they could share and what insect problems they wanted more information about; the exchange was then designed around their responses. Scientists were invited who either had expertise that would supplement the information of the farmers on a particular topic or who had insight into an insect problem the farmers wanted to solve.

The exchange addressed general principles on the first day, including the effects of soil and plant health on susceptibility to pests, the role of crop diversification in insect management and encouraging biological control, and the history and current practice of biological control. On the second day, small group sessions addressed insect management in related groups of veg-

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SARE Grant

\$20,000

Match

\$21,910

Duration

1997 to 1999

Project Number

LNE97-82



etable crops. The information presented at the exchange illustrated both the similarities and the differences across the Northeast. The 14 farmers making presentations came from eight northeastern states; every state in the region except Rhode Island was represented by at least one farmer, scientist, or farm advisor. In addition, two scientists from outside the region (Ohio and Georgia) were invited for their particular expertise.

Potential Contributions and Practical Applications

Because this exchange addressed insect pests in many different vegetable crops, and because the information exchanged was on a continuum between basic research and farmer adoption, it is difficult to quantify the potential contributions. I will present a single example here.

At the exchange, Dr. Ruth Hazzard presented a biointensive program for the management of caterpillars, including the European corn borer, the corn earworm, and the fall armyworm, in fresh market sweet corn. This program provided commercially acceptable levels of control using only *Bacillus thuringiensis* (B.t.) and direct application of vegetable oil to the corn silks. The cost per acre of this program is comparable to the conventional IPM program currently used in Massachusetts, is less than a typical non-IPM program. Research suggests that some of the B.t. sprays might be eliminated and the cost of the program reduced by annual inoculative releases of *Trichogramma ostriniae*. Because of the labor required for direct application of oil to corn silks, the biointensive program with no use of chemical insecticides may be limited to farms with less than 20 acres of sweet corn ripening at once. In many parts of the Northeast, where fields are small and most growers have multiple plantings to spread out the season, this would be feasible, but the percentage of total corn acreage would be diffi-

cult to quantify.

These alternatives, if widely adopted, could have an impact on the quantity of insecticides used on sweet corn in the Northeast. Through the exchange and through the book of proceedings to be produced next year, this project will spread information about alternatives to these insecticides to a wider range of farmers and farm advisors and will reduce insecticide use in vegetables.

Farmer Adoption and Direct Impact

Farmer adoption of the practices discussed at the exchange will depend on many factors—farmers cited the severity of a particular pest on their own farms, the scale on which they grow a particular vegetable crop, the commercial availability of certain tools such as the lure for striped cucumber beetle or the applicator to efficiently put oil into the tip of the ear to control corn earworm, and differences in the time available in different climates for certain cultural operations such as killing and incorporating cover crops.

Much of the discussion was about how soil building, plant health, and crop diversification might affect insect management. This discussion may result in changes in thinking and overall strategy of individual farmers, but the application to specific farming operations will rely on the experimentation and observation of the farmer.

Dissemination of Findings

The exchange itself disseminated the findings of leading researchers in biological and cultural insect management to farmers, and also outlined the findings of farmer and researchers to professional scientists. The book of proceedings will make the presentations and discussions available to a much wider audience of farmers, farm advisors, researchers, and others.

Reported December 1998



Sustainable Integrated Management of Weeds & Diseases in a Cabbage Cropping System

Summary

This project will identify crop rotation schemes and other management practices that suppress weeds and diseases in cabbage crops. The weed studies will focus on common ragweed and velvet leaf, while the disease management component looks at *Alternaria* leaf spot, white mold, and gray mold. Previous studies suggest that these weeds are hosts for these diseases. The project includes fully integrated treatments, and the results should be immediately relevant to crucifer growers nationwide.

Objectives

- ◆ Identify crop rotation schemes that suppress weeds and disease development in subsequent cabbage crops.
- ◆ Identify sustainable weed and disease management practices that result in integrated control of both pests.

Abstract

To meet the objectives of the study, seven rotation schemes and five weed and disease management treatments are proposed. The replicated studies will be conducted in three locations. The weed management component will focus on common ragweed (*Ambrosia artemisiifolia*) and velvetleaf (*Abutilon theophrasti*), while the disease management component will focus on *Alternaria* leaf spot (*Alternaria brassicicola*), white mold (*Sclerotinia sclerotiorum*), and grey mold (*Botrytis cinerea*).

Research conducted in New York has shown that velvetleaf and common ragweed are susceptible hosts for *S. sclerotiorum* and *B. cinerea*. The pathogens infect the flowers of common ragweed and velvetleaf and then move passively from the infected and wilted weeds to the healthy cabbage plants. The key to control of white and gray molds on cabbage is to control the weeds in the field. Thus, the interrelated nature of disease development and weed population density in cabbage fields make this project a superb candidate for a truly integrated and sustainable approach to pathogen and weed management.

The proposed project contains fully integrated treatments, and the results of this research will produce beneficial cropping sequences that can be immediately implemented by crucifer growers nationwide. This project will have an economic impact on cabbage growers because the rotation schemes can reduce or eliminate the need for expensive pesticide applications, and can reduce pathogen populations that destroy cabbage heads that results in costly yield losses in the field and in storage.

Approved for funding March 1998

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SARE Grant

\$140,000

Match

\$56,730

Duration

1998 to 2001

Project number

LNE98-102





water quality



Managing Dairy Waste Using Constructed Wetlands and Composting

Summary

This project is exploring two alternative technologies—constructed wetlands and composting—to treat and manage liquid (milking parlor effluent) and solid (barn manure) dairy wastes. The research addresses the environmental and economic viability of these technologies, which may be best management practices for treating livestock waste.

Objectives

- ◆ To educate farmers and others about low-cost options for the management of dairy waste.
- ◆ To promote more sustainable options for dairy waste disposal for farmers and provide opportunities for supplemental income generation.
- ◆ To train certified nutrient managers and extension personnel throughout Maryland in the use of constructed wetlands and composting.
- ◆ To expose both rural and surrounding urban communities to alternative, environmental-friendly waste management systems.
- ◆ To determine the effectiveness of constructed wetlands in treating dairy parlor effluent.
- ◆ To evaluate the use of waste pretreatment structures in improving the efficacy of constructed wetlands.
- ◆ To assess effects of seasonality on the wetlands' ability to treat waste.
- ◆ To demonstrate the feasibility of using composting to deal with solid dairy waste.
- ◆ To test several low-tech composting methods for stabilizing solid waste from dairy barns and parlors.
- ◆ To evaluate potential feedstocks for co-composting of dairy waste.
- ◆ To assess the economic feasibility of establishing alternative waste management practices on dairy farms.
- ◆ To evaluate the possible profit from marketing composted materials.
- ◆ To compare costs of conventional dairy waste treatment systems with those of constructed wetlands and composting.

Findings to Date

The initial water quality analyses indicated that the wetland system is providing a high level of treatment. However, the pretreatment structures (a settling basin and an aerated tank) were resulting in relatively little removal of most constituents.

Wetlands are probably unsuitable for treating highly concentrated dairy waste, but are effective in sustainably removing nitrogen and phosphorus from waste waters that have been pretreated to remove the bulk of suspended solids and reduce elevated ammonia concentrations.

Economic analyses indicate these systems may be useful as components of integrated waste management systems for dairy facilities.

Methods and Findings

Disposal of dairy waste has become an important issue for moderate to large-scale confined-animal dairy farms. In many instances, more manure and liquid waste is produced than

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Collaborators

University of Maryland

SARE Grant

\$110,305

Match

\$128,250

Duration

1996 to 1998

Project number

LNE95-62

MD

Project number

LNE95-62

can be applied safely to surrounding crop fields, particularly in areas where herd sizes per unit of land are increasing. Current modes of waste treatment and disposal include direct land application of solids and temporary storage of liquid wastes in lagoons, followed by land application. These practices can lead to nutrient saturation of soils and release of nutrients and solids to streams, lakes, and estuaries.

The majority of our objectives have been met. We completed the composting study in 1996 and the economic analysis of composting and constructed wetlands in 1997. We finished construction of the wetland treatment system (including settling basin and aeration tank pretreatment structures) in 1997. This had been delayed due to unusually wet weather during 1996 and by dieback of some of the planted vegetation over the winter of 1996-97.

The first milking parlor effluent was introduced into the wetland cells in September of 1997, and we have collected samples monthly from various points throughout the system. Our analysis covered biochemical oxygen (BOD₅), chemical oxygen demand (COD), total suspended solids (TSS), ammonia, nitrate/nitrite, total nitrogen, ortho-phosphate, total phosphorus, dissolved oxygen, temperature, pH, and electrical conductivity.

The initial results of water quality analyses indicated that the wetland system provides a high level of treatment, with removal efficiencies above 90% for most parameters. However, our data also indicated that the pretreatment structures (a settling basin and an aerated tank) were resulting in relatively little removal of most constituents, and that the bulk

of the removal was occurring in the wetland cells themselves.

During 1998, we continued our monthly water quality monitoring and description of changes in wetland plant community structure. Early in the 1998 growing season we observed browning of wetland vegetation near the waste inflow point, possibly the result of elevated ammonia concentrations. We collected plant samples for biomass analysis at inflow and outflow points to assess the reduction in growth due to stress.

Because of the low efficiency of the pretreatment structures and the potential for stress to vegetation, we modified the system to obtain waste from two large settling ponds. Although the ponds receive waste from the entire dairy operation, its outflow had lower waste concentration. This is wastewater that would otherwise be recirculated through the system or applied to fields.

In 1997 we held a well-attended in-service training workshop for livestock and nutrient management specialists on constructed wetlands and composting.

Our findings to date indicate that wetlands are probably unsuitable for treating highly concentrated dairy waste, but are effective in sustainably removing nitrogen and phosphorus from waste waters that have been pretreated to remove the bulk of suspended solids (which will eventually fill in the wetland cells) and reduce elevated ammonia concentrations (which can kill wetland vegetation). Because our economic analyses of the wetland and composting systems indicate that construction and operational costs are similar or less than those of conventional waste management practices, these systems may be useful as components of integrated waste management systems for dairy facilities

Reported January 1999

Producing Native and Ornamental Wetland Plants in Constructed Wetlands Designed to Reduce Pollution from Agricultural Sources



Summary

This project at a wholesale plant nursery will demonstrate an economical system for treating nursery runoff in a constructed wetland that is also producing native and ornamental wetland plants. The goal is to produce a high-demand crop while addressing non-point source pollution on the site.

Objectives

- ◆ To demonstrate an economical solution to treating nursery runoff by growing, harvesting, and selling native and ornamental wetland plants produced in a constructed wetland treating runoff from a commercial nursery.
- ◆ To evaluate the economic impact of converting nursery production space into a treatment wetland production space.
- ◆ To research the possibility of enclosing treatment wetlands in passively heated polyhouses to facilitate year-round treatment of agricultural runoff.
- ◆ To distribute the results of this study to farmers and other agricultural businesses or professionals interested in treating runoff with created wetlands via a Cooperative Extension or outreach program consisting of seminars, workshops, field trips, slide shows, and fact sheets.

Abstract

Degraded water quality is a growing concern across the Northeast, and in many cases may be linked to agricultural operations as non-point sources of nitrate and phosphorous pollution. Constructed wetlands have emerged as effective, low-cost methods of water treatment that have the potential to reduce agricultural non-point source pollution and contribute to agricultural sustainability. However, the costs of implementing treatment wetlands as a best management practice are high, with little opportunity for cost recovery.

We propose to demonstrate an economical solution to treating nursery runoff that incorporates into a treatment wetland the wholesale production of native and ornamental wetland plants. Our goal is to offer farmers an opportunity to produce a high-demand crop while addressing non-point source pollution on their land. We will evaluate the economic impact of converting nursery production space into treatment space. We will also research the possibility of enclosing treatment wetlands in passively heated polyhouses to facilitate the year-round treatment of agricultural runoff. Information gathered from both the on-farm demonstration and research sites will be extended to farmers and other agricultural businesses or professionals through outreach programming.

Approved for finding March 1998

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Collaborators

Ecological Engineering Associates
New England Wetland Plants
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Rhode Island Department of
Environmental Management
University of Rhode Island
USDA-NRCS

SARE Grant

\$72,840

Match

\$60,663

Duration

1998 to 2000

Project number

LNE98-100

RI



farmer grants

Farmer Projects:

Reports from the Field



The science writer Lewis Thomas once pointed out one of mankind's overlooked virtues: "If we were not provided with the knack of being wrong," he said, "we would never get anything useful done."

In these summaries of farmer projects funded by SARE, you will meet farmers who set out to solve a problem, often a problem about pest management, marketing, crop feasibility, or production strategy. Not every project was a resounding success in terms of outcomes, but, as Thomas reminds us, success has certain accidental properties. What comes out of the farmer grants projects is information: Is it better to frighten deer with Mylar strips, flashing Christmas lights, or chicken wire? What's the best way to control cranberry fruitworm? Will different varieties of wheat grow in Vermont? What can be done to improve the delivery system of organic poultry and lamb to respond to consumer demand?

In this context, the journey becomes more important than the mere fact of arrival. SARE's farmer grant program is built around the belief that these modest, targeted efforts offer an element of surprise and allow producers to explore ideas that arise directly from daily demands on the ground and daily experience. The grants are small, and are marked by the same variety that marks the agricultural community, with its complexities and challenges.

Because this is a summary, and because space is limited, not every project is included here—by summarizing, we can give you an idea of the variety of Farmer Grant projects without getting too long-winded. Some farmer grant outcomes are reported in the Northeast SARE newsletter, *Innovations*, and the Northeast SARE office is happy to respond to inquiries about project outcomes and application procedures. You can write to us at Northeast SARE, Hills Building, University of Vermont, Burlington, VT 05405-0082, call us at 802-656-0471, or e-mail us at nesare@zoo.uvm.edu.



Farmer Projects:

Reports From the Field

FNE97-178

A Consortium of Sheep Dairies

Cynthia Major

Putney, Vermont

Cynthia Major makes cheese from the milk of her own sheep, which she sells under the label "Vermont Shepherd." She has found a healthy demand for her product, and would like to expand production to meet it. Rather than investing to increase her own production—and incurring the headaches that would go along with managing a larger operation—she preferred to create a consortium of sheep dairies, each producing its own cheese to a common standard, but curing and marketing their product collectively.

In 1996, Major recruited four farmers and put them through an apprentice cheese making program at her farm. She wanted to continue and expand the program in 1997, with the involvement of more technical expertise, and applied for a SARE grant to help her make this happen. She then recruited various experts in sheep, pasturing, and cheese making and marketing. These experts made frequent visits to the participating farms and provided instruction and advice on sanitation, record-keeping, equipment, technique, quality control, and other subjects. They also conducted taste tests, took samples for laboratory analysis, gave feedback, and discussed various problems as they arose. While this was going on, Major and her associates compiled a resource list for would-be cheese makers, and wrote a guide, which they copyrighted, called "The Joy of Cheese Making." The project ended with a workshop for other interested sheep farmers.

FNE97-185

Field Trials of New Wheat Varieties

Ken van Hazinga

Orwell, Vermont

When wheat is grown in Vermont, it is generally soft white winter wheat that, with its low protein content, is suitable for pastries, biscuits, and noodles, but not for bread. Since they are not generally grown in Vermont, little information exists on performance and yield of bread wheats in this area. The principal objective of this project was to address this deficit.

This study compared the performance of seven varieties of spring wheats: 'Oxen,' 'Brio,' 'Russ,' 'Diablo,' 'Sharp,' 'Katepawa,' and 'Classic.' 'Classic'

is a hard white; all the rest are hard reds. They were planted in four replications in a randomized complete block design. Another field was planted to just one of these varieties, to chart expenses and determine a production budget applicable to all of them.

A similar trial of six varieties of beans was also conducted, as a complementary crop to wheat in a rotation. The bean varieties tried were: 'Calypso,' 'Soldier,' 'Maine Yellow Eye,' 'Jacob's Cattle,' 'Vermont Cranberry,' and 'Black Turtle Soup.' All the crops, both wheat and beans, were grown under organic management. Measurements were made of grain and straw yield, and milling and baking qualities. Disease and pest incidence were also observed.

In the wheat trial, 'Classic' suffered badly from smut, leaf rust, and aphids, 'Diablo' from leaf rust, and 'Oxen' from a stem-boring maggot. 'Katepawa's' seed heads had a peculiar twisted appearance, from which they recovered after a time. The biggest pest problem, which affected all the wheat varieties, was birds.

'Oxen' and 'Brio' had the highest grain yields, at about 38 bushels per acre—for comparison, Cornell reports typical winter wheat yields in New York of about 50 bushels per acre. 'Katepawa' yielded the most straw, at 1.6 tons per acre. Figuring in costs of \$99.70 per acre, the most profitable of the varieties tried, based on either grain alone or the combined value of grain and straw, was 'Oxen,' with 'Brio' a close second.

As for milling quality, which is the percent of grain convertible to flour, 'Oxen' and 'Katepawa' were given excellent ratings for yield, at 73% and 71% respectively. 'Oxen,' 'Sharp,' 'Katepawa,' and 'Classic' obtained high ratings for sedimentation. 'Oxen' and 'Sharp' had the highest test weights, at 61 pounds per bushel. All varieties had protein contents above 14%, which is very high; 'Katepawa' had the highest, at 15.2%.

Protein content after baking was highest for 'Katepawa,' but all varieties rated well. 'Oxen' had the lowest ash content at 0.5%, which is still higher than one would like. Flour color of all varieties was dull to slightly creamy. Greatest volume increases on baking were registered for 'Classic,' 'Katepawa,' 'Diablo,' and 'Oxen'; the best grain texture was observed for 'Brio,' 'Russ,' and 'Sharp.'

Van Hazinga concluded that, overall, the 'Oxen' variety was the most promising spring wheat for

Addison County, Vermont, and that 'Katepawa' and 'Brio' also showed promise. There is a caution: spring wheat can suffer considerable loss where the ground remains wet too long. Farmers planting spring wheat in heavy soils, such as the clays that predominate in much of Addison County, should seek out the better-drained locations.

In the bean trials, the grain drill used to plant unfortunately distributed the seeds very erratically. The trial also suffered heavy weed pressure and a bad infestation of potato leafhoppers. Despite these problems, yields for all varieties other than 'Black Turtle Soup' were remarkably similar, ranging from 10.2 to 11.3 bushels per acre. 'Black Turtle Soup' yielded 17.4 bushels per acre where density was on the order of 73,000 plants per acre, and 40.7 bushels per acres where it was 162,000 plants per acre, making it far and away the most productive. Still, at \$1.30 per bushel, and figuring in production costs of \$149.40 per acre, none of the bean varieties was profitable. To those who may be interested in growing beans anyway, the authors suggest planting with a corn planter. They also advise 'Maine Yellow Eye' and 'Soldier' as more suitable for machine harvesting, as the pods of these varieties are higher up off the ground.

FNE97-163

Scaring Off the White-Tailed Deer

Myra Bonhage-Hale

Alum Bridge, West Virginia

Myra Bonhage-Hale is a gardener in the midst of a large population of deer. In her own words: "Three deer deterrents were proposed, to ascertain whether these organic, non-destructive methods would keep deer from eating tomato plants. They were a tansy hedge, rose-scented geranium bushes, and blinking Christmas lights around 10 foot by 12 foot plots of organic tomato plants with six plants in each plot. Deer damage was first noted on each of these plots (including a control plot) eighteen days after installation. Undeterred by this failure, the grantee labored on with new ideas. A second trial was conducted with plastic flats laid around the tomatoes, pink netting saturated with essential oil of rose-scented geranium around a second plot, and Mylar strips enclosing a low bamboo fence around the third plot. Deer damage ensued within eight days for the rose-scented geranium oil, nine days for the plastic flat trays, and seven days for the flut-

tering Mylar strips. Again, spurred on by obsessive perseverance, a third trial was enacted. A tent of chicken wire, a web of filament line, and a chicken-wire drape were observed for deer dalliance. Three plants in the tent of chicken wire were eaten in ten days, while three lived on for a month before being mysteriously devoured; the chicken-wire drape worked for fourteen days, and the web lasted fifteen days. Another experiment, conducted separately, involving a cage canopy with bells, wind chimes, dangling ribbon and raffia was successful."

An entertaining photograph of this final installation has made the rounds at SARE, and will likely be included in a future issue of *Innovations*. Bonhage-Hale thinks that most of her deterrents worked for a limited period, but she believes that period grew shorter once the deer had learned that there were vegetables growing in the area. She suggests that the best way to deal with them would be to rotate among several deterrents, changing them every ten days or so, time and money permitting. She also believes that a system incorporating difficult-to-see barriers and sudden lights, sounds, and motion, particularly motion that mimics the alarmed flick of a deer's tail, and triggered by the movement of the approaching animal, would be worth trying.

✓ FNE96-159

Organic Activism in Connecticut

Tony Norris

New Britain, Connecticut

While organic growers in Connecticut and elsewhere are served by the Northeast Organic Farmers Association (NOFA), Mr. Norris felt that his area needed another organization to focus more on the marketing of their produce. Together with other organic farmers in Connecticut, Mr. Norris applied for and obtained a SARE grant to establish what came to be known as the Certified Organic Associated Growers (COAG) of Connecticut.

The objectives of this group are to establish liaisons with cooperatives, explore marketing strategies, promote organic agriculture, and market the produce of its member farms. Mr. Norris and his associates incorporated COAG as a nonprofit organization in January, 1997. Other COAG activities include lobbying for the reform of statutes that pertain to organic food and agriculture, participating in Connecticut's Agriculture Day and Agricultural Exposition, bringing together buyers with COAG mem-



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ber growers, organizing an all-organic farmers market, and publishing promotional literature, including leaflets and a bumper sticker.

Mr. Norris reports that the exchange of ideas that takes place during COAG's regular meetings has engendered enthusiasm and activism among the members. Many have become newly active in NOFA and Farm Fresh, which governs the state's farmers' markets. Some have found new markets through COAG and some have launched small marketing ventures of their own.

FNE98-203

Row Covers and the Squash Vine Borer

Bryan O'Hara

Lebanon, Connecticut

Squash vine borer has been a persistent problem for Bryan O'Hara, who grows vegetables organically in eastern Connecticut. His SARE project involved using cotton row covers and varying the planting dates of his squash as deterrents for this pest. The row covers present a physical barrier to the borers, but they must be removed at flowering to permit pollination. By varying his planting dates, O'Hara hoped that the very early plantings might already be bearing fruit by the time the first squash vine borer moths arrived around the first of July, and that they would have departed by the time the row covers were removed from the late plantings.

O'Hara planted squash at intervals from May 6 to July 15. The earliest planting was started indoors and later transplanted to the field. Half of each planting was covered with a cotton row cover, held over the plants on wire hoops, and the other half was left uncovered.

He found that the earliest plantings yielded the best. The first two plantings were already yielding before squash vine borers became a problem, and, being larger and hardier than the later plantings, were better able to resist the infestation when it arrived. Later plantings suffered even if they were covered, because the covers had to be removed when they flowered in the middle of the infestation.

Squash plants growing under row covers grew faster and appeared healthier than uncovered plants of the same planting date. Besides keeping squash vine borers off the plants, the row covers also kept striped early-season cucumber beetles and squash bugs away and also deterred deer and groundhogs.

The greatest yield, by a considerable margin, came from the covered plants of the earliest planting.

O'Hara recommends the row covers. Besides deterring pests, they are easy to handle, can be used over many seasons, when worn out they can be composted, and, at 30 cents a foot, they are economical. He also recommends early planting, but intends to continue to experiment with very late plantings for winter squash.

FNE98-208

High Quality Sheep Cheese ✓

Suzanne Sankow

Lyme, Connecticut

Suzanne Sankow and her husband raise sheep. They market the wool and meat themselves, and make cheeses and yogurt from the milk. They wanted to learn how to make higher quality cheeses, which command a better price, and for which the market is strong, so Ms. Sankow applied for a SARE grant to bring Alfred Michiels, an expert on sheep's milk cheeses, from Belgium.

Michiels conducted a five-day workshop at the Sankow's farm, attended by Ms. Sankow and three others. The workshop covered various facets of cheese making, including the use of starters and rennet, sanitation, equipment, pasteurization, brining, aging, and pressing. Together they made several cheeses, including Brindamour, Belgium Abbey, Manchego, and Pyrénées.

The Sankows have taken some of the cheese made at the workshop to her local farmers market. She found that the Brindamour sold for \$16 a pound, twice the price of the Feta that she had been making. She intends to continue to use her newly acquired skills, and to expand her operation by infusing high-milk-producing East Frisian stock into her herd, and by increasing the size of her cheese making facility. She has sent samples of her cheeses to three experts, whose feedback will provide a check on quality.

FNE97-160

***Echinacea* in Cultivation**

Angela Baker

Charlemont, Massachusetts

The genus *Echinacea* comprises several species of flowering plants whose leaves, seeds, and roots are reputed to have medicinal properties. They are rarely cultivated, and the practice of gathering them in the wild has drastically depleted native populations. This, combined with rising demand, has driven up the price substantially.

Ms. Baker was interested in assessing the potential of *Echinacea* as a field crop. Toward this end, she experimented with two species—*E. purpurea* and *E. angustifolia*—to determine their growth requirements. She grew these under organic management, and experimented with the stratification requirements of the seed, planting density, soil pH, interplanting with various other species, and sowing into various cover crops. She also compared growth in sunlight with growth in partial shade, and direct seeding into the field with transplanting from a greenhouse.

For *E. purpurea*, Baker reports that stratification for two weeks in the dark at 35° to 40°F, followed by seeding onto a compost-based potting soil, gave 87% germination. Temperature was maintained at 70° to 80°F for the few days between sowing and germination. Ms. Baker recommends vermiculite as the medium for stratification, as this holds plenty of water, and can be easily separated from the seed by wet sieving, though it is not really necessary to do so. The seeds should be sown on the soil surface, without incorporation, as light promotes germination. Baker recommends sowing indoors, and later transplanting to the field. She obtained poor emergence when she tried sowing directly into the field, though she does feel this merits further investigation, especially sowing into perennial grasses. She says a temperature of 68°F or higher is necessary for germination. Plants can be kept indoors in flats for as long as ten weeks before being transplanted to the field, though she recommends transplanting three to four weeks after sowing. Transplanting may be done as early as four weeks before the date of last possible frost. The young plants are quite cold tolerant; they are tolerant of heat and drought as well. She had success with transplants as late as July 23. She recommends preceding the *Echinacea* with a cover crop of sweet

clover, for the nitrogen it fixes, as well as its ability, as a deep-rooted crop, to loosen the soil. She obtained best results with a soil pH between 5.0 and 6.1, and found the plants grew best in partial to full sunlight.

The most vigorous growth of *E. purpurea*, and the greatest number of flower heads, were observed when it was grown interplanted with grasses. Baker concludes that this is a suitable plant for cultivation in the Northeast.

E. angustifolia proved much more difficult. Percent germination, following stratification treatment similar to that given *E. purpurea*, was lower and more variable. Transplanting must be done later, after the last possibility of frost. *E. angustifolia* fared best in well-drained soil in full sun, but irrigation was necessary throughout the first growing season. Like *E. purpurea*, *E. angustifolia* thrived when interplanted with grasses, and neither species suffered notably from diseases or insects. Ms. Baker does not recommend *E. angustifolia* for cultivation in her area.

FNE97-164

Strawberries in High-Tunnel Greenhouses

Doug Coldwell

South Deerfield, Massachusetts

Doug Coldwell grew three varieties of strawberries in high tunnel greenhouses, which are simple, unheated, unelectrified structures. The three varieties were Annapolis, Kent, and Northeast. He planted late (on June 1, 1997) in raised beds and staggered double rows, and followed organic practice throughout. In August, he sowed oats along the walkways for weed control and to supply some of the mulch that would be required for winter cover. He applied mulch in November, removed the mulch the following March, and covered the greenhouses (which until this point had remained uncovered) with a double layer of plastic sheeting. He harvested strawberries from May 18 to June 15, 1998.

He found that one-foot spacing within rows, and between the two rows of the double row, was a good planting density—the beds filled in nicely. He also reports that the late planting date facilitated weed control, and that sowing oats late in the establishment year worked well. The raised



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beds made cultivation with a rototiller more difficult, and improved drainage excessively on his light-textured soil. He recommends raised beds only for heavy soils. Trickle irrigation is recommended, and he found that the high tunnels protected the berries from too much wetness and saved the bulk of his crop. Other field growers suffered severe losses to the excessive rains during June of 1998.

Use of the high-tunnel greenhouses allowed him to bring his berries to market three-and-a-half weeks before field-grown berries were ready in his area. He believes that covering the high tunnels earlier than March of the second year would have allowed him to bring his fruit to market even earlier. If this is to be done, the structure must be built to bear a load of snow.

He did encounter problems. Regulating temperature inside the tunnels can be challenging. Also, Coldwell used a whisk broom for pollination, and he reports that this was too rough on the blossoms, and suggests a leafblower or bees instead. Of the varieties tested, 'Annapolis' yielded about half again as much as either 'Kent' or 'Northeaster.' He received a wholesale price of \$1.75 per pint. Coldwell says that this is an excellent price, but that even so, it was not enough to cover his expenses. Yields would have to be higher, he says, to make this system of growing strawberries worthwhile.

FNE97-184

Dogs in the Berry Patches

Rudy Valonen

East Longmeadow, Massachusetts

Rudy Valonen and his son grow strawberries, blueberries, and raspberries. Over the years, their crop, and their blueberries in particular, have suffered serious degradation from birds. Growers commonly use netting to keep birds away from berry bushes, but at more than \$3000 per acre, the cost of netting is nearly prohibitive.

The Valonens thought that it might be possible to use dogs as an alternative means of bird control. They experimented with two breeds—the Finnish Spitz and the Australian Cattle Dog. They used dogs of both sexes. They used one adolescent; the rest were mature animals. Each dog was kept by itself in blueberry plantings of an acre-and-a-half to two acres, and its behavior was observed over the sea-

son as the berries ripened. Random clusters of blueberries were marked and counted beforehand to permit quantitative assessment of the degree of protection provided by each dog.

The Valonens obtained the best results from a mature female Spitz. Compared to the other dogs, she was less distracted by people and animals such as woodchucks and mice, and she appeared to have a natural inclination to prowl her area. She did tend to lie down and rest during the hottest part of the day, but that really didn't represent too much of a problem, since the birds are less active then, too.

Control was far from perfect, but the Valonens believe that with the right dogs and proper training they could focus the animals' attention more completely on birds and eventually increase their effectiveness.

FNE95-86

Mulches Living and Otherwise

Judith Hall

Rutland, Vermont

Dr. Judith Hall grows flowers organically, and her SARE project involved a comparison of various mulches, both living and otherwise, as alternatives to cultivation.

Dr. Hall sowed perennial ryegrass, chewing fescue, and tall fescue in some of her inter-rows. She placed a layer of old canvas in another inter-row, and a layer of kraft paper covered with sawdust in another. Finally, one inter-row was cultivated, to serve as a control.

Dr. Hall reports that of the living mulches, perennial ryegrass filled in the best. She reports that the old canvas was the easiest mulch to apply, and at the end of the summer was easily rolled up for storage until the following season. Old canvas could also be readily trimmed to accommodate small variations in the width of the inter-row, in order to obtain maximum coverage. The kraft paper was difficult to apply, but, being biodegradable, did not have to be handled at season's end.

Dr. Hall does not express a preference for any one of these mulches, but says that all effectively controlled weeds and substantially reduced labor requirements. The summer of 1997 was notably dry and 1998 notably wet, but the grasses thrived under both meteorological extremes. All treatments were trafficable, and all provided a better working surface than the bare earth left by cultivation.

FNE97-166

Soil Management and Mechanical Cultivation

Richard de Graff

Pulaski, New York

Richard de Graff and his associates at the Northeast Organic Farmers Association circulated a questionnaire to organic growers in New York, and the responses indicated that their greatest needs, as far as professional training is concerned, were more information about soil and its management and instruction on mechanical cultivation. To address these needs, de Graff obtained a SARE grant to conduct a workshop on each of these two subjects. Both workshops were advertised through the Cornell Cooperative Extension newsletter and in the local press. The one on mechanical cultivation was held in May of 1997 at Cornell's Freeville Experiment Station, and was attended by approximately 30 people. The session included viewing of a videotape, discussion of equipment and its use, and demonstrations of various pieces by Dr. Robin Bellinder of Cornell University.

A soil fertility workshop was held in December at the Cooperative Extension office in Auburn, New York, and was attended by about 75 people. Will Brinton of Woods End Agricultural Institute in Maine addressed the gathering on soil fertility, soil biology, and compost, and demonstrated a field test kit for soil fertility of his own device.

FNE97-167

Reintroducing Ginseng

Stephen Drane

Auburn, Maine

American ginseng, or *Panax quinquefolius*, is indigenous to much of the eastern US and Canada, but, due to unsustainable harvesting and destruction of habitat over the past 250 years, the wild plant can scarcely be found anywhere anymore. Demand for the root of the plant as a putative medicinal and aphrodisiac remains high, and this is reflected in the price, which reaches well into the hundreds of dollars per pound. It consequently occurred to Dr. Stephen Drane, and others in Maine, that reintroduction of the plant might prove lucrative, and could provide another option, more aesthetic and less destructive than logging, for those who try to make their living off the forest.

Drane applied for a SARE grant for the newly-es-

tablished Maine Ginseng Growers Association (MeGGA), of which he is a board member. MeGGA used this grant to expand its membership, promote the "wild-simulated" growing of ginseng, and explore marketing possibilities. Among other activities, MeGGA has compiled a guide for growers, put together information leaflets, and sent representatives to numerous conferences, fairs, and expositions. MeGGA has also conferred with public officials regarding legislation pertinent to ginseng, developed a web site, and put on conferences, lectures, and field days of its own. Further goals include the cataloging of all known wild stands in Maine, the preservation of endangered local varieties in a seed bank, further expansion of the membership, and the development of trade fairs, to which buyers from around the world will be invited to view and purchase this product of the Maine woods.

FNE97-174

The Search for Better Basil

Gregory Kellett

Amherst, Massachusetts

Synthetic cytokinins are commonly applied to ornamental plants to promote lateral branching. This makes them fuller and bushier, and makes them more marketable. The same sort of growth is also desirable in herbs, but these chemicals are not approved by the Food and Drug Administration for use on edible plants, so the only alternative available to growers is to pinch off the apical meristems by hand, a labor-intensive, and consequently expensive, procedure.

Gregory Mr. Kellett explored an alternative, and used his SARE grant to spray his herbs with suspensions of harmless bacteria that are known to produce cytokinins. He grew suspensions of three bacterial species, *Rhizobium leguminosarum*, *Corynebacterium fascians*, and *Agrobacterium gluteans*. These he sprayed on hydroponically-grown Genovese basil three times per week, every other week, for six weeks. Some plants were left untreated as controls, and others were treated with 10, 15, or 20 milligrams per liter concentrations of synthetic cytokinins. When the plants were six weeks old they were harvested, and height, lateral branch length, average distance between internodes, and dry leaf mass were measured.

Kellett reports considerable variability of all de-



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pendent parameters within treatments, and no significant differences between treatments. Notably, even the sprays of artificial cytokinins did not produce any effect, by comparison with the untreated control. He suggests that cytokinin concentrations in the bacterial suspensions may have been too low, but that would still not account for the lack of observed effect in the case of the artificial cytokinins. He suggests also that the cytokinins may have been unable to penetrate the cuticle of the basil. If this is the case, Kellett's idea may still be valid for herbs with less impenetrable cuticles.

FNE97-175

Attracting Native Bees for Pollination

Sanford Kelley
Jonesport, Maine

This project was a continuation of Mr. Kelley's earlier project, FNE96-138. Both involved efforts to attract native bumble bees and leafcutter bees as alternatives to renting hives for pollination of blueberries and cranberries.

Nesting boxes and bales of straw for the bumble bees, and wooden nesting blocks for the leafcutters, had been placed around Mr. Kelley's farm and that of his neighbor for the earlier project. Monitoring of these nesting sites continued, and more nesting sites were added. Crocuses and hyacinths were planted to provide the bees with pollen and nectar during the period before the blueberries and cranberries come into bloom. Observations were made from time to time to estimate bee densities and determine species.

Kelley reports increases in the numbers of leafcutters and bumble bees during the two years that he has been involved in this work. Bumble bees are more numerous, but in a sense the increase in the population of leafcutters is more dramatic, since at first these were scarcely observed at all. The bumble bee species observed were *Bombus ternarius*, *B. impatiens*, *B. affinis*, and *B. vagans*. Two genera of leafcutters were observed—*Megachile* and *Osmia*.

The bumble bees continued, as before, to avoid the straw bales and nesting boxes prepared for them; the leafcutters continued to occupy anywhere from a tenth to a third of the nesting blocks that had been put out for them. It seems likely that the increased bee population has more to do with availability of food than of shelter, particularly consider-

ing that the largest increase in bumble bee population was observed in a blueberry field that had a sizeable population of leatherleaf weeds. Leatherleaf provides bees with forage before the blueberries begin to bloom.

Kelley believes that placing nesting sites for leafcutter bees is worthwhile, and he intends to continue the practice. Providing nesting sites for bumble bees does not appear to be worth the effort.

FNE97-177

Covering Against Cranberry Fruitworm

Michael Macfarlane
Ellsworth, Maine

Michael Macfarlane has a small organic cranberry bog. In a previous SARE project (FNE96-143) he experimented with non-chemical means of controlling cranberry fruitworm. Of the various measures he tried, only one—covering the plants with plastic row covers—appeared to have any appreciable effect, and this not for the reason postulated. His expectation of the row covers was that they would, by heating the soil underneath, promote early emergence of adult moths, which could then be caught on sticky traps under the plastic. What he found was that the adults easily escaped through ventilation holes in the plastic, but that the females were apparently reluctant to return through the vents to deposit their eggs on the berries. Macfarlane applied for another SARE grant to examine more closely the effects of row covers.

In this project he tried three treatments: a spunbonded polypropylene cover fixed in place for the season, a clear vented plastic cover likewise fixed in place, and a polypropylene cover placed over the rows each evening and removed each morning. This last treatment is feasible because the adults leave the bog each day, and only return at night to lay their eggs.

Macfarlane found that the permanent polypropylene row cover was virtually 100% effective at preventing loss to cranberry fruitworm. However, fruit set under this cover was poor, apparently because pollinators had difficulty getting to the flowers. Fruit rot in these locations was also a problem, probably because of the higher humidity.

Pollination was satisfactory under the vented plastic, and the loss to cranberry fruitworm there was negligible. However, weed control became a se-

rious problem in these rows. Macfarlane believes the weed competition in turn caused delayed maturity of the crop.

The most successful treatment by far was the one involving daily removal and replacement of the row cover. Where this was done the loss to cranberry fruitworm was negligible, fruit set was satisfactory, rot was not a problem, and weed control was facilitated. The labor cost was substantial, but Macfarlane believes it may be possible to bring the labor cost down to a more reasonable level by covering larger areas, concentrating on only the most productive parts of the bog, or monitoring more closely the egg-laying behavior of the insect pest. He intends to continue experimenting along these lines on his own.

FNE97-183

Meeting the Demand for Fresh, Local, Organic Meat

Judith Sheehan

Enosburg Falls, Vermont

Judith Sheehan produces organic lamb and poultry. She feels that because of inefficiencies in processing, marketing, and distribution, her production is far less than what it could be. Using a SARE grant, she conducted a statewide survey of organic producers, retailers, and processors to examine the feasibility of processing and marketing cooperatively.

Sheehan concluded from her surveys, which are available in detail, that the demand for organic lamb and poultry is substantial in Vermont, and is not currently being satisfied by local producers. The results showed that retailers feel that local origin is more important draw than organic husbandry—there is a general belief on the part of consumers that locally-produced meats are fresher.

Sheehan reports that there is much room for improvement and systematization in the marketing of organic meats; slaughterhouses are lacking in Vermont, and the few that there are, are not well-distributed geographically. She is now working to secure a permanent, year-round outlet for Vermont-raised organic meats in Burlington, Vermont, outside the usual retail channels. She is also encouraging the state legislature and the Department of Agriculture, among others, to promote processing and marketing of organic lamb and poultry in Vermont.

FNE96-149, FNE97-180 and FNE98-217

Export Markets for Goats and Goat Semen

Lydia Ratcliff

Chester, Vermont

This has been a three-year effort directed at developing export markets for goats and goat semen. Ms. Ratcliff's work has involved contacting potential exporters—goat owners and their associations and cooperatives throughout the Northeast—as well as veterinarians, livestock brokers, and various personnel in Cooperative Extension and state departments of agriculture whose assistance is required in exporting goats and semen. She has also been compiling information about goats from the Northeast into promotional literature, contacting potential buyers overseas, and sending them this literature. This effort includes gathering information that will be needed by exporters, such as shipping costs and foreign regulations governing imports. At the same time, she has been building up a bank of frozen semen taken from goats whose dams were exceptional producers of milk.

Now in its third year, the project is seeing results. With the help of others, often other goat farmers, Ms. Ratcliff had compiled a list of some 200 breeders in the New York and New England area who have quality animals and semen available for export, and this group has established a quarantine and semen collection operation in Schenectady, New York. She has also put together data sheets and a color catalog of the animals whose semen is for sale, familiarized herself with the relevant health regulations of several countries, and made several mass mailings to prospective customers in various parts of the world. These efforts have led to sales in Canada, Mexico, and Taiwan, and resulted in leads for other possible sales.

Ms. Ratcliff has established contact with many breeders, goat associations, charitable organizations, cheese-makers, U.S. agricultural attachés, and others, often by means of the Internet. Prospects for further sales seemed very good indeed until the current economic depression took hold in East Asia, South America, and other parts of the world. Ms. Ratcliff remains confident, however, as the economies in these regions appear to be starting to recover.



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FNE97-188

Sugar from Sorghum

John Williamson

North Bennington, Vermont

John Williamson began working with sweet sorghum in the hope of finding a use for his maple sugaring equipment during times of the year when it is not needed for rendering maple syrup. In his two earlier projects (FNE95-114 and FNE96-157) he determined that sorghum can be grown successfully in southern Vermont, but that not just any cultivar will do. He also found that his evaporating pan, while generally serviceable for sorghum, required some modification—sorghum sap has a much higher sugar content than maple, and is thus more prone to burn. In this his third and final SARE project dealing with sweet sorghum, Williamson conducted variety trials and made adjustments to his equipment.

Williamson grew thirty cultivars of sorghum at three locations around Bennington, Vermont. Soil texture and fertility, competition from weeds, and management practices differed among the sites. He evaluated each variety for its rate of maturation and the sap of each for sugar content and taste. When harvesting sorghum for syrup it is not necessary to wait for the grain to mature; in fact, peak sugar content occurs at the soft dough stage. Because of Vermont's short growing season, Williamson prefers early-maturing sorghum so that he can collect the seed of these somewhat hard-to-come-by varieties

himself. Uniformity of maturation is also preferable, as this facilitates harvesting.

For most varieties, maturation was not uniform from one site to another, and drought during the summer of 1997 delayed all of them. Mr. Williamson did, however, observe uniformity in these six cultivars—'Blackstrap,' 'Early Orange,' 'Early Orange 2,' 'Waconia Orange,' 'Simon,' and 'Umbrella.' He determined that a sap sugar content of 13% or more, as determined by a Brix reading, is necessary to make harvesting worthwhile, and he observed this level, in early October, in the 'Moes Miller,' 'Smith,' 'Della,' 'Orange,' 'Simon,' 'Ames Amber,' and 'Waconia Orange' cultivars. Among these high-sugar varieties, those with the best taste were 'Della,' 'Ames Amber,' and 'Waconia Orange.'

To harvest the sorghum, Williamson modified a corn harvester to cut the stalks and chop them into three-inch billets that can be easily fed to a press. He also designed a new evaporating pan, with the help of a collaborator, for use with either sorghum or maple sap.

Williamson has demonstrated his sorghum syrup, and the process by which he makes it, at the Vermont Maplerama Tour, and his project has been written up repeatedly in *New England Country Folks*, *The New England Farmer*, *Sugarmaker*, and other periodicals. He also spoke about his variety trials at the 1997 conference of the National Sweet Sorghum Producers and Processors Association.

1999 Farmer Grants



Farmer Projects:
1999 Grants

The following producer projects were approved for funding in January of 1999. For more information about a particular project, please call, write, or e-mail Northeast SARE. Please refer to the project number when making inquiries.

FNE99-272

CGM (Clean Green Machine): A Hydroponic System

David S. Roberts, Cheshire, Connecticut. \$4,520

FNE99-268

Improving Protein Utilization in Grazing Dairy Cows with Liquid Molasses Supplementation

Ginger Myers, Manchester, Marland. \$4,175

FNE99-238

Spring Hydroseeding of Switchgrass on Winter Wheat

Franklin Chow, Centre Hall, Pennsylvania. \$1,830

FNE99-282

Determining Production Costs of Vegetables in Diversified Small-Scale Organic Systems

Ryan Voiland, Montague, Massachusetts. \$1,000

FNE99-231

Using Milk House Waste Water for Alternative Cash Crop Production

Brent and Regina Beidler, Randolph Center, Vermont. \$3,750

FNE99-266

Sustainable Turkey Production for the Small Farmer

Jennifer Lynn Megyesi, South Royalton, Vermont. \$2,070

FNE99-244

Winter Wheat Trials with Response to Composts for Maine

Mark Fulford, Monroe, Maine. \$4,900

FNE99-281

Slow Release Natural/Organic Fertilizers in Nursery Crop Production

Richard Tregidgo, Pleasant Mount, Pennsylvania. \$1,590

FNE99-277

Controlling Late-Season Diseases of Scab-Resistant Apple Cultivars

Alan Surprenant, Ashfield, Massachusetts. \$693

FNE99-252

Cooperative Internship Training Program

Elizabeth Henderson, Newark, New York. \$3,475



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1999 Grants

FNE99-280

A Low-Cost Method of Trapping Out Apple Maggot Flies

Maurice Tougas, Northboro, Massachusetts. \$1,062

FNE99-234

"Green" Greenhouse: An Affordable, Energy-Efficient Greenhouse for Cold Climates

Colleen Caffery, Leyden, Massachusetts. \$2,511

FNE99-247

Identification of Local Ethnic Needs for Livestock

Jennifer Gilligan, Richmond, Vermont. \$4,904

FNE99-249

Alternative Use of Seasonal Forage Crops: Triticale, Field Peas, and Brassicas

Christian D. Gowdy, Walpole, New Hampshire. \$750

FNE99-258

Evaluating the Effectiveness of Non-Chemical Methods in the Control of Tarnished Plant Bug in Strawberries

Joseph Klein, Plainfield, Vermont. \$2,230

FNE99-237

High-Density Maple Sugar Orchard and Tapping of Immature Trees

Charlie Chase, Greene, Rhode Island. \$3,000

FNE99-260

Caged-Fish Production in the Lawrence River

Jeff Lazore, Hogansburg, New York. \$6,800

FNE99-242

Alternative Control Methods for Grape Leafhopper

Richard Figiel, Lodi, New York. \$1,515

FNE99-270

Small Breeders' Meat Marketing Project

Lydia Ratcliff, Chester, Vermont. \$7,650

FNE99-245

Managed Intensive Grazing

Cindy Gallagher, Sangerfield, New York. \$8,041

FNE99-265

Mulching with Black Plastic Drainage Pipe

Lawrence McDonald, Marion Station, Maryland. \$2,390

FNE99-279

**Control of Eastern Red Cedar by
Nutrient Management and Intensive Grazing**

Jason Teets, Ronceverte, West Virginia. \$8,500

FNE99-248

Pastured Poultry Products

Barb Gorski, Bernville, Pennsylvania. \$3,660

FNE99-233

Evaluation of Forage Soybeans

Tim Brown, Littleton, Pennsylvania. \$745

FNE99-230

Farm-Based Sustainable Agriculture Education Programs

David Batchelder, Stratham, New Hampshire. 2,850

FNE99-232

**An Examination of Production Practices for
Two Varieties of the Root Crop Valerian**

Christof Bernau, Canterbury Shaker Village, Canterbury, New Hampshire. \$2,745

FNE99-253

**Comparing Quality and Yield of Different Grass Species
in a Dry Hay Two-Cut System**

Donald T. Hill, Cattaraugus, New York \$1,820

FNE99-239

**The Farmer-to-Market Web Site:
A Meat Processing and Delivery Resource Survey**

Perry Ells and JoAnn Hollis, Lincolnville, Maine. \$2,480

FNE99-284

Dairy Slurry Management

Carl Williams and Anna Dawson, Kinderhook, New York. \$3,637

FNE99-276

**Estimating the Sustainability and Productivity of a
Meat Goat Operation on New York Pastures**

Tatiana Stanton, Trumansburg, New York. \$6,286

FNE99-267

Amending Soils to Produce Blueberries in Maryland

Guy and Lynn Moore, Woodbine, Maryland. \$1,523

FNE99-250

**Economic and Environmental Impact of
No-Till Processing Tomatoes vs. Conventional Processing Tomatoes**

Steve Groff, Holtwood, Pennsylvania. \$1,950.



Farmer Projects:

1999 Grants



Farmer Projects:

1999 Grants

FNE99-241

Rootswork 1999—Community-Based Research, Demonstration, and Education Activities

Linda Faillace, Rootswork, Warren, Vermont. \$4,693

FNE99-235

Dietary Water Needs of Lactating Dairy Cows on Management-Intensive Grazing

Dan and Ann Carey, Groton, New York. \$784

FNE99-246

Intensive Grazing System

Milford Gibson, Bruceton Mills, West Virginia. \$2,515

FNE99-262

Developing Sustainable Production Practices for Currants and Gooseberries

Rodolfo Lopez, Hudson, New York. \$5,700

FNE99-283

Sustainable Production of Specialty Cut Flowers Through Improved Soil Structure

Pam West, Lewisburg, West Virginia. \$2,154

FNE99-275

Promoting Summer Lettuce/Mesclun Growth and Preventing Deer Damage with Shadecloth

Judy Smeltzer, New Milford, Pennsylvania. \$511

FNE99-251

Sustainable Organic Production of Blueberries in Maryland

Robert G. Hamilton, Baldwin, Maryland. \$4,384.

FNE99-261

Garlic-Based Spray on Cabbage Worms

David Lefever, Sabillasville, Maryland. \$1,040

FNE99-257

Dairying in Hartford County: Transition to Intensive Grazing

David Keyes, Harve de Grace, Maryland, \$6,050

FNE99-256

Growing Cranberry-Specific Parasitoids for Application on Organic Cranberry Bogs

Kristine Keese, Plymouth, Massachusetts, \$2,675

FNE99-271

Phosphorus Content of Composts

Eric Rice, Middletown, Maryland, \$7055

FNE99-243

Compost Planting Pots

Matthew Freund, East Canaan, Connecticut, \$700

FNE99-263

No-Tillage Transplanted Watermelons in Rye Cover Crop

Mike Malone, Salisbury, Maryland. \$5,308

FNE99-286

Integrated Forest Farming: Medicinal Herb Cultivation, Mushroom Production, and Forest Restoration

Frederick D. Hays, Elkview, West Virginia. \$7,995

FNE99-290

Riparian Buffers

Dexter King, Benson, Vermont. \$5,000

FNE99-285

Ginseng Grown Under Pawpaw Trees

Daniel Cosgrove, Chloe, West Virginia. \$1665

FNE99-287

Ginseng Dead Heading: Determining the Effects of Deflowering Woods-Grown Ginseng Plants

Steve and Karen Galloway, Frederick, Maryland. \$2,363

FNE99-289

Creating a Demonstration Agroforestry Field

Dori Green, Corning, New York. \$4,100

FNE99-288

Propagation of Superior, Straight Growing Black Locust (*Robinia pseudoacacia*, 'Haudenosaunee') through Agroforestry

Dave Gell, Jacksonville, New York. \$1,945

FNE99-291

Make the Farm Profitable Using Agroforestry

Bill Slagle, Bruceton Mills, West Virginia, \$6,000

FNE99-269

Evaluating a No-Till Transplanter for Organic Vegetable Production

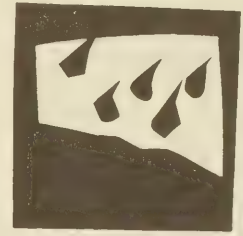
Drew Norman, White Hall, Maryland, \$3,072



Farmer Projects:

1999 Grants

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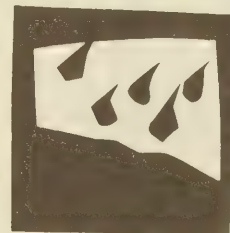
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1999 Resource Guide

SARE works hard to get research results and practical information on sustainable agriculture to people who need it, and the following list has been developed to help you acquire publications, videos, and other resources you may find useful.

We used information from project reports to assemble as complete a list as possible of SARE-supported resources available in early 1999. It's possible, though, that we missed a few. If your materials were not included in the list, or if you've recently completed a publication, video, or other information resource, please let us know and we'll include it in the next publication of this list. We may also list it in the resources section of our newsletter, *Innovations*.

SARE Publications

To order, contact Northeast SARE. Unless otherwise specified, SARE publications are free. Write us at Northeast SARE, Hills Building, University of Vermont, Burlington VT 05405. Phone: 802-656-0471. E-mail: nesare@zoo.uvm.edu

Innovations, the three-times-a-year newsletter of the Northeast Region SARE Program.

Northeast Region SARE Progress Report, 1996 to 1999 editions. Limited quantities.

"National SARE Project Highlights," 1997 to 1999 editions. 12 pages. Brief and colorful summaries of research across the nation.

10 Years of SARE. 1998. 96 pages. Case studies of 40 projects from around the country. Limited quantities.

"Exploring Sustainability in Agriculture." Eight-page color bulletin describing several approaches to more profitable, environmentally sound farming.

The Real Dirt: Farmers Tell about Organic and Low-Input Practices in the Northeast, second edition. 264 pages. Edited by Miranda Smith and Elizabeth Henderson, with members of the Northeast Organic Farming Association and Cooperative Extension. \$13.95.

SAN: Publications, Databases, On-line Materials.

The Sustainable Agriculture Network (SAN) is the outreach arm of the national SARE program. A number of resource publications, handbooks, electronic products and networking opportunities are available. A national database of SARE projects and other information is also on line via the SAN/SARE web site at <http://www.sare.org/>. For more information about SAN, contact coordinator Andy Clark at 301-504-6425 or san@nal.usda.gov.

To order SAN publications by credit card call 802-656-0484, or send a check or purchase order payable to Sustainable Agriculture Publications, Hills Building, UVM, Burlington VT 05405-0082. For information about bulk discounts and rush orders, call 802-656-0484 or e-mail nesare@zoo.uvm.edu.

"Diversify Crops to Boost Profits and Stewardship." 12-page color bulletin. Highlights the ways farmers

can profitably diversify in response to today's economic conditions. Topics include alternative cash crops, cover crops, and agroforestry. Available in print or at <http://www.sare.org/san/diversify/> where you can download an Adobe Acrobat file for printing. Free.

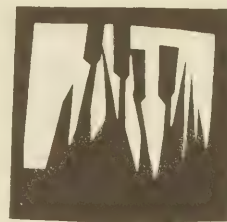
Managing Cover Crops Profitably, second edition, 1998. 212 pages. A practical guide to using cover crops to save money, prevent soil erosion, and prevent pest problems. \$19.

"Profitable Dairy Options: Grazing, Marketing, Nutrient Management." 1995. An eight-page color bulletin focusing on rotational grazing, new marketing approaches, and some references for feedlot oriented approaches. Free.

The Source Book of Sustainable Agriculture. A national guide to 500-plus handbooks, web sites, newsletters, conference proceedings, bulletins, videos, and other resources. Each entry has a detailed product description and ordering information. \$12. An updated electronic version is available on the web, where you can add your organization or materials at <http://www.sare.org/san/htdocs/pubs/>.

Steel in the Field: A Farmer's Guide to Weed Management Tools. 1997. 128 pages. A farmer-oriented handbook with 45 drawings accenting technical descriptions on tool roles, designs, and costs. Index, contact list, tool sources. \$18.

Sustainable Agriculture Directory of Expertise, third edition. The 1996 edition of this popular list of experts is somewhat dated, but contains valuable information on how to connect with people who are changing the way America farms. Soon to be updated on the web, where you can add yourself, at <http://www.sare.org/san/htdocs/pubs/>.



1998 Resource Guide

Northeast SARE Publications, Videos, Web Sites and More

The following resources were developed through Northeast SARE-supported projects. Listings include the resource title, the publication in which it appeared, if any, and ordering information. Unless otherwise specified, materials are free.

Agronomic Crops

"Annual Cover Crops for Maryland Corn Production Systems." Agronomy Mimeo 34. Write: A. Morris Decker, Natural Resource Sciences and Landscape Architecture, HJ Paterson Hall, University of Maryland, College Park MD 20742-5821.

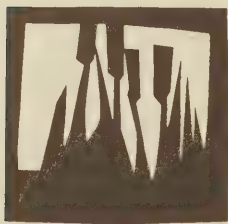
The IPM Field Corn Pocket Guide. 280 pages, 80 line drawings, 18 color plates, 40-plus tables. This guide concisely presents information on scouting and managing insect pests, beneficial insects, corn plant diseases, vertebrate pests, grass weeds, and broadleaf weeds. \$7 plus \$3.50 shipping and handling in the US. Contact NRAES, 152 Riley-Robb Hall, Ithaca NY 14853-5701. Phone: 607-255-7654. Credit cards accepted.

"Rotated Corn Can Enhance Yields with Less Inputs," in *What's Cropping Up*, Vol. 7, No. 2. Two-page article summarizing benefits achieved from alternative rotations. Contact William Cox, Cornell University 141 Emerson Hall, Ithaca NY 14853.

"Sustainable Agriculture Practices for Field Crop Production in the Northeast." 12-minute video released in 1991. \$19.95 (includes shipping in the US). Contact Resource Center, Cornell Business and Technology Park, Building 7 and 8, Cornell University, Ithaca, NY 14853. Phone: 607-255-2080. Credit cards accepted.

Bees

"Blueberry and Cranberry Pollination: A Comparison of Managed and Native Bee Foraging Behavior," in the Proceedings of the International Symposium on Pollination. Bulletin on the care, handling, and management of the ALB on wild lowbush blueberry. University of Maine Cooperative Extension. Obtain photocopies from Connie Stubbs, Department of Biological Sciences, 5722 Deering Hall, University of Maine, Orono ME 04469.



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Community Agriculture Development

Community Agriculture Development Packets: "Adding Value for Sustainability," "Adding Value with Small Scale Food Processing and Specialty Dairy Products," "Agricultural Economic Development," "Agritourism," "Developing New Markets to Support Local Agriculture," "Engaging the Public in Local Agricultural Issues," "Urban Connections and Community Food Security," and "Who Will Farm? Supporting Farm Families and Farm Workers." \$5 each plus shipping and handling. Send check payable to Cornell University to Farming Alternatives Program, 17 Warren Hall, Cornell University, Ithaca NY 14853-7801. Phone: 607-255-9832. E-mail: jmp32@cornell.edu.

"Putting Cooperation to Work," by Brian Henehan, Brice Anderson, Timothy Pezzolesi, and Robert Campbell. A loose-leaf binder on developing a cooperative featuring case studies, resources, and background material. Developed as support material for a videoconference, this guide book has found wider use as a general resource. \$25. Also available is an edited video of the conference itself, about 2 hours, \$29. Handbook and video combined, \$45. Contact Cornell University Media Services Resource Center, 7-8 Business Technology Park, Ithaca NY 14850. Phone: 607-255-2080.

Community-Supported Agriculture

CSA Farm Network, Vols. I and II, by Steve Gilman. These books include materials gathered during the formation of a network linking all CSA farms in the region. Volume I (1996) is \$6; Volume II (1998) is \$8. Write Steve Gilman, CSA Network, 130 Ruckytucks Road, Stillwater NY 12170.

Sharing the Harvest: A Guide to Community-Supported Agriculture, by Elizabeth Henderson with Robyn Van En. 1999. Chelsea Green Publishing, \$24.95. A handbook for starting and running a CSA farm, published in partnership with Northeast SARE. Covers basic tenets, useful strategies, and operational models. Charts, resources, index. \$24.95. Call 800-639-4099; go to www.chelseagreen.com, or write to Chelsea Green Publishing, PO Box 428, 205 Gates-Briggs Building, White River Junction VT 05001.

Various articles, fact sheets and reprints on CSAs, including a directory and resource list. Daniel Lass, 236 Draper Hall, University of Massachusetts, Amherst MA 01003-2040.

Farmer-to Farmer-Learning

"Farmer- to-Farmer Learning Groups," by Kathy Barrett, in collaboration with D. Merrill Ewert. 1998. A 20-page guide to establishing and maintaining successful farmer learning groups. Cornell Cooperative Extension, 276 Roberts Hall, Ithaca NY 14853. Phone: 607-253-2237.

Food Processing

Adding Value for Sustainability: A Guidebook for Cooperative Extension Agents and Other Agriculture Professionals, by Kristen Markley and Duncan Hilchey. 1998. 110 pages. Guide to small-scale food processing enterprise development. Includes practical information on food safety, financing, marketing and community support strategies. \$8.50 plus \$3 shipping and handling. Send check payable to PASA to Pennsylvania Association for Sustainable Agriculture, PO Box 419, Millheim PA 16854. Phone: 814-349-9856.

The Cornell University *Farming Alternatives* newsletter publishes articles from time to time about farm-based and other small-scale food processing issues. Subscribe for \$10 a year. Cornell Farming Alternatives Program, 17 Warren Hall, Cornell University, Ithaca, NY 14853-7801. Phone: 607-255-9832. E-mail: jmp32@cornell.edu.

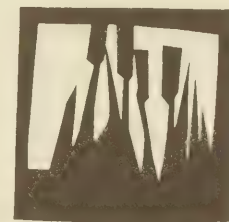
Greenhouse Production

Proceedings of the Northeast Farmer-to-Farmer Information Exchange on greenhouse production. \$3.95 plus \$1.50 postage. NOFA-NY, PO Box 21, South Butler NY 13154-0021.

K-12 Curricula

"Compost Laboratory: Guidelines and Lessons for Studying Composting in the Classroom," a teacher's guide to lesson plans and hands-on activities for studying composting in school curricula. Available in the fall of 1999. For price and availability contact Woods End Research Laboratory, Old Rome Road, Route 2, Box 1850, Mt. Vernon ME 04352. Phone: 207-293-2457.

"Resource Conservation and Environmental Stewardship," the *Maryland Agriculture in the Classroom Agriculture Education Sourcebook*, briefly describes activities, lesson plans, and curriculum catalogues. Pickering Creek Environmental Center, 11450 Audubon Lane, Easton MD 21601.



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Livestock Systems—General

"Beef Cattle, Feeding Broiler Litter, Growing Kenaf on Small Plots." Fact sheet. Contact: Cooperative Extension, 910 South Chappall Street, University of Delaware, Newark DE 19736.

Proceedings of the Northeast Farmer-to-Farmer Information Exchange on livestock. \$3.95 plus \$1.50 shipping. NOFA-NY, PO Box 21, South Butler NY 13154-0021.

Livestock Systems—Grazing

"Concepts of Sustainability and the Pasture Ecosystem," a 12-page bulletin by Lori Unruh and Gary W. Fick. 1997. Five principles of environmental sustainability are defined and described as they occur in an intensively managed pasture ecosystem. SCAS Teaching Series No. T97-1. Write: SCAS, Cornell University, Ithaca NY 14853.

Grazing in the Northeast: Assessing Current Technologies, Research Directions and Education Needs. 1998. 220 pages. Proceedings from the 1998 "Grazing in the Northeast Workshop." \$30 plus \$5 shipping and handling. Write NRAES, 152 Riley-Robb Hall, Ithaca NY 14853-5701. Phone: 607-255-7654. E-mail: nraes@cornell.edu. Credit cards accepted.

Greener Pastures on Your Side of the Fence, fourth edition, by William Murphy. 380 pages. A comprehensive book on Voisin controlled grazing. \$30 plus \$2.50 shipping and handling. Send checks payable to Arriba Publishing to 212 Middle Road, Colchester VT 05446.

"Voisin Controlled Grazing Management: A Better Way to Farm and Equipment for Maximum Net Forage Production." Videos. \$30 for both. Send checks payable to UVM to Department of Plant and Soil Science, 12 Hills Building, University of Vermont, Burlington VT 05405.

Livestock Systems—Manure and Nutrient Management

"Getting a Manure Sample," University of Maine Cooperative Extension Bulletin 2428. Write: Tim Griffin. University of Maine, 495 College Avenue, Orono ME 04473-1294.

"Manure: What its Worth on Your Farm?" handout. Tim Griffin, address above.

"Understanding A Manure Sample." University of Maine Cooperative Extension Bulletin 2429. Tim Griffin, address above.

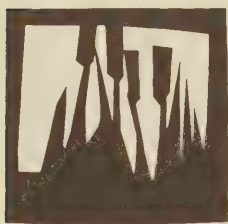
What Farmers Need to Know about Water Pollution. 200 pages. Addresses ways to reduce non-point water pollution, manage nutrients, and applicable laws and regulations. Sponsored by the Maine Farm Bureau. Tim Griffin, address above.

Marketing

"Farmers and Their Diversified Horticultural Marketing Strategies." 1999. One-hour video shows how eight farmers successfully use roadside stands, farmers markets, CSAs, sales to restaurants, internet sales and wholesale cooperatives. \$15. Send check payable to UVM to Center for Sustainable Agriculture, 590 Main Street, Burlington VT 05405-0059.

On-Farm Research

"On-Farm Demonstrations." 1996, booklet, Pennsylvania State University, Blair and Huntingdon Counties, PO Box 449, Highland Hall Annex, Hollidaysburg PA 16648-0449.



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Ornamentals

"The Sustainable Plant List—Sustainable Trees and Shrubs for Southern New England," second edition. 1995. \$4. Write: Cooperative Extension, The University of Rhode Island, Kingston, RI 02881-0804.

Potatoes

"New Products for Colorado Potato Beetle Management," in *Spudlines*, a University of Maine Cooperative Extension publication. One-page summary of alternatives to chemical management. Kathleen Murray, University of Maine, Deering Hall, Orono ME 04469.

"Sustainable Alternative Management Techniques for the Colorado Potato Beetle." Video. Focuses on trench traps and propane flaming. \$15. Cornell Cooperative Extension, 246 Griffing Avenue, Riverhead, NY 1190. Phone: 516-727-7850.

"Integrated Pest Management Guide in Potatoes." 1995. First copy free, then \$2.70 each for additional copies. Send check payable to PSU to Publication Distribution Center, Pennsylvania State University, 112 Agricultural Administration Building, University Park PA. 16802-2602. Phone: 814-865-6713.

"The Ecology, Economics and Management of Potato Cropping Systems: A Report of the First Four Years of the Maine Potato Ecosystem Project." Maine Agricultural and Forest Experiment Station, University of Maine, 5782 Winslow Hall, Orono Maine 04469-5782.

Small Fruit—General

Small Fruit Production and Pest Management Guide, 1996. \$10. Send check payable to PSU to Publication Distribution Center, College of Agricultural Sciences, Pennsylvania State University, 112 Agricultural Administration Building, University Park PA 16802-2602. Phone: 814-865-6713.

Small Fruit—Blueberries and Cranberries

University of Massachusetts *Cranberry Station* newsletter covers topics such as winter flood management and IPM approaches to pest management. Available from UMASS Extension, Amherst MA 01003-0099.

"Blueberry and Cranberry Pollination: A Comparison of Managed and Native Bee Foraging Behavior," in the Proceedings of the International Symposium on Pollination. Bulletin on the care, handling, and management of the ALB on wild lowbush blueberry, published by University of Maine Cooperative Extension. Obtain photocopies from Connie Stubbs, Dept. of Biological Sciences, 5722 Deering Hall, University of Maine, Orono ME 04469.

Small-Fruit—Grapes

Organic Grape and Wine Symposium Proceedings, \$10, plus \$3 for shipping and handling. Write the New York State Agricultural Experiment Station, Geneva NY 14456.

Small Fruit—Strawberries

"Cool Climate Strawberries Fare Well on Plastic," in *American Fruit Grower*, 1997. Joseph Fiola, Rutgers University Fruit Research and Education Center, 283 Route 539, Cream Ridge NJ 08514.

"Integrated Pest Management for Strawberries in the Northeastern United States: A Manual for Growers and Scouts." A University of Massachusetts Cooperative Extension publication. \$7. Write Bulletin Center, Draper Hall, University of Massachusetts, Amherst MA 01003. Phone: 413-545-2717.

Proceedings of the Northeast Farmer-to-Farmer Information Exchange on strawberries. \$3.95 plus \$1.50 postage. NOFA-NY, PO Box 21, South Butler NY 13154-0021.

"Proper Plant Type, Planting Date and Double Cropping Optimize Profitability of the Strawberry Plasticulture System," abstract in *The County Agent*. Joseph Fiola, Rutgers University Fruit Research and Education Center, 283 Route 539, Cream Ridge NJ 08514.

"Update on the Strawberry Plasticulture System," in *Hort News* 77(4). Joseph Fiola, address above.

"Strawberry Plasticulture Considerations for Colder Production Areas," "Strawberry Plasticulture in Maryland," and "Strawberry Cultivar Selection," all in the Proceedings of the 1997 Southeast Strawberry

Expo, available for \$10 from the North Carolina Strawberry Association, 1138 Pittsboro NC 27312. E-mail: ncstrawberry@mindspring.com.

Tree Fruit

Management Guide for Sustainable Apple Production, \$12. Send check payable to UVM to Plant and Soil Science Department, Hills Building, UVM, Burlington VT 05405. Phone: 802-656-2630.

1998-1999 New England Apple Pest Management Guide. \$15. Send check payable to UVM to Plant and Soil Science Department, Hills Building, UVM, Burlington VT 05405. Phone: 802-656-2630.

Proceedings of the Northeast Farmer-to-Farmer Information Exchange on apples. \$3.95 plus \$1.50 postage. NOFA-NY, PO Box 21, South Butler NY 13154-0021.

Virtual Orchard. Web site: www.orchard.uvm.edu/

Urban-Farm Connections

Proceedings from the "New Connections in the Northeast Food System" conference, March 1997. \$20. Hartford Food System, 509 Weathersfield Ave, Hartford CT 06115. Phone: 860-296-9325. E-mail: hfoods@erols.com.

Guides to purchasing locally grown produce for food service staff and marketing to institutions for farmers. \$10. Contact Hartford Food System, address above.

"Making Room at the Table: A Guide to Connecticut Food Security." Applicable to other states, regions. \$5. Contact Hartford Food System, address above.

Vegetables—General

"New Cultivation Tools for Mechanical Weed Control in Vegetables." Bulletin 102FSNCT. Solid overview of various cultivation implements. \$1.50 per copy, with bulk discounts for orders over 10 copies. Call Cornell University Media Services Resource Center, 607-255-2080, or write 7 Cornell Business and Technology Park, Ithaca NY 14850.

"New Tools for Mechanical Weed Control." 12-minute video. \$7. Contact: Robin Bellinder, Department of Fruit and Vegetable Science, 164 Plant Science Building, Ithaca NY 14853. Phone: 607-255-7890.

Northeast Cover Crop Handbook. Published by the Rodale Institute. 12.95 plus \$5 shipping and handling within the US. Call 800-832-6285 to order, or write to Rodale Institute Research Publications, 611 Siegfriedale Road, Kutztown PA 19530.

"Vegetable Farmers and Their Weed Control Machines." Video. 40 minutes. From sweeps and rotary hoes to flame weeders and homemade tools, this 75-minute video shows the diversity of cultivation tools available and explains the weed controls strategies being effectively used by New England vegetable farmers. \$12. Send check payable to UVM to the Center for Sustainable Agriculture, 590 Main Street, Burlington VT 05405.

Vegetables—Sweet Corn

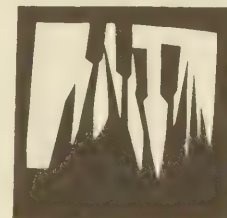
"Biointensive Insect Management in Sweet Corn." 1999. Four-page bulletin. Write Ruth Hazzard, Entomology Dept., Agricultural Engineering Building, Amherst MA 01003. Phone: 413-545-3696.

"Managing Sweet Corn Pests in Massachusetts." Four-page bulletin with color pictures that is relevant region-wide. Includes information about trapping, scouting, thresholds, insect life cycles. Bulletin IPMA1100CORN. \$1.75. University of Massachusetts Bulletin Center, Draper Hall, University of Massachusetts, Amherst MA 01003. 413-545-2717.

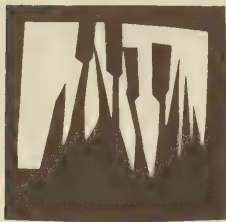
"Nitrogen Recommendations for Corn Using Pre-sidedress Soil Nitrogen Test," FS 569. Write Publications Distribution Center, Cook College, Rutgers University, P.O. Box 231, New Brunswick NJ 08903.

Proceedings of the Northeast Farmer-to-Farmer Information Exchange on sweet corn. \$3.95 plus \$1.50 postage. NOFA-NY, PO Box 21, South Butler NY 13154-0021.

"Soil Testing To Manage Nitrogen for Sweet Corn." FS 95-1. University of Connecticut Cooperative Extension. Write to the Agricultural Publications Department, University of Connecticut, Storrs CT 06269-4035.



1998 Resource Guide



1998 Resource Guide

"Using *Bacillus Thuringiensis* (Bt) Products for European Corn Borer Control in Sweet Corn." 1997. Seven pages. \$3. Publication C-220. University of Massachusetts Bulletin Center, Draper Hall, University of Massachusetts, Amherst MA 01003. Phone: 413-545-2717.

Various articles and bulletins about pre-sidedress soil nitrate testing in sweet corn and other vegetables. Richard Ashley, Department of Plant Science, University of Connecticut, Storrs CT 06269-4067.

Water Conservation and Water Quality

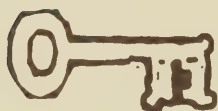
"A Guide to Saving Water for the Small Farm or Backyard Garden," an eight-page bulletin from the University of Rhode Island, W. Alton Jones Campus, 401 Victory Highway, West Greenwich RI 02817.

"Building Sustainable Partnerships for Agriculture: A Case of Watershed Protection," an 18-minute video documenting collaboration between agencies, farmers and businesses to protect the Musconetcong Watershed in northwestern New Jersey from non-point-source pollution. Includes a discussion guide to help incorporate similar communication and collaboration strategies into other projects. \$25. Center for Environmental Communication, Cook College, 31 Pine Street, New Brunswick NJ 09801-0231. Phone: 732-932-8795. E-mail: cec@aesop.rutgers.edu.

"The German Branch Watershed Project," a 36-minute video on the practices of Maryland farmers who are working together to protect water quality in Queen Anne's County and the Chesapeake Bay. \$10. Jim Hanson, Maryland Cooperative Extension Service, 1202 Symons Hall, University of Maryland, College Park MD 20742-5565. Phone: 301-405-7992. E-mail: jhanson@arec.umd.edu.

Water Pollution, Agriculture Conference: What Farmers Need to Know about Water Pollution. Approximately 200 pages on ways to reduce non-point water pollution, manage nutrients, and applicable laws and regulations. Sponsored by the Maine Farm Bureau. Contact: Tim Griffin, University of Maine, 495 College Avenue, Orono ME 04473-1294.





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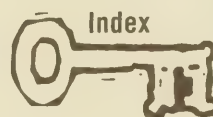
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A note to the reader:

Because of time and production constraints, not every current Northeast SARE project is described in this report. Information about projects is available by calling us at 802-656-0471, or by e-mailing nesare@zoo.uvm.edu.

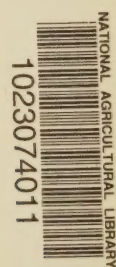
If you would like to learn more about the SARE grants programs, feel free to call or e-mail for current application materials.

credits

cover art	cover design
Bonnie Acker	Helen Husher
project summaries	copy editing
SARE Project Coordinators	Helen Husher, Michael Levine
Farmer Grant summaries	page design
Jim Gardiner	Casey Chapple
resource listings	type & production
Beth Holtzman	Helen Husher



SARE project reports were written by the project investigators. Any opinions, findings, conclusions, or recommendations expressed in them do not necessarily reflect the views of the USDA or the Northeast SARE program.

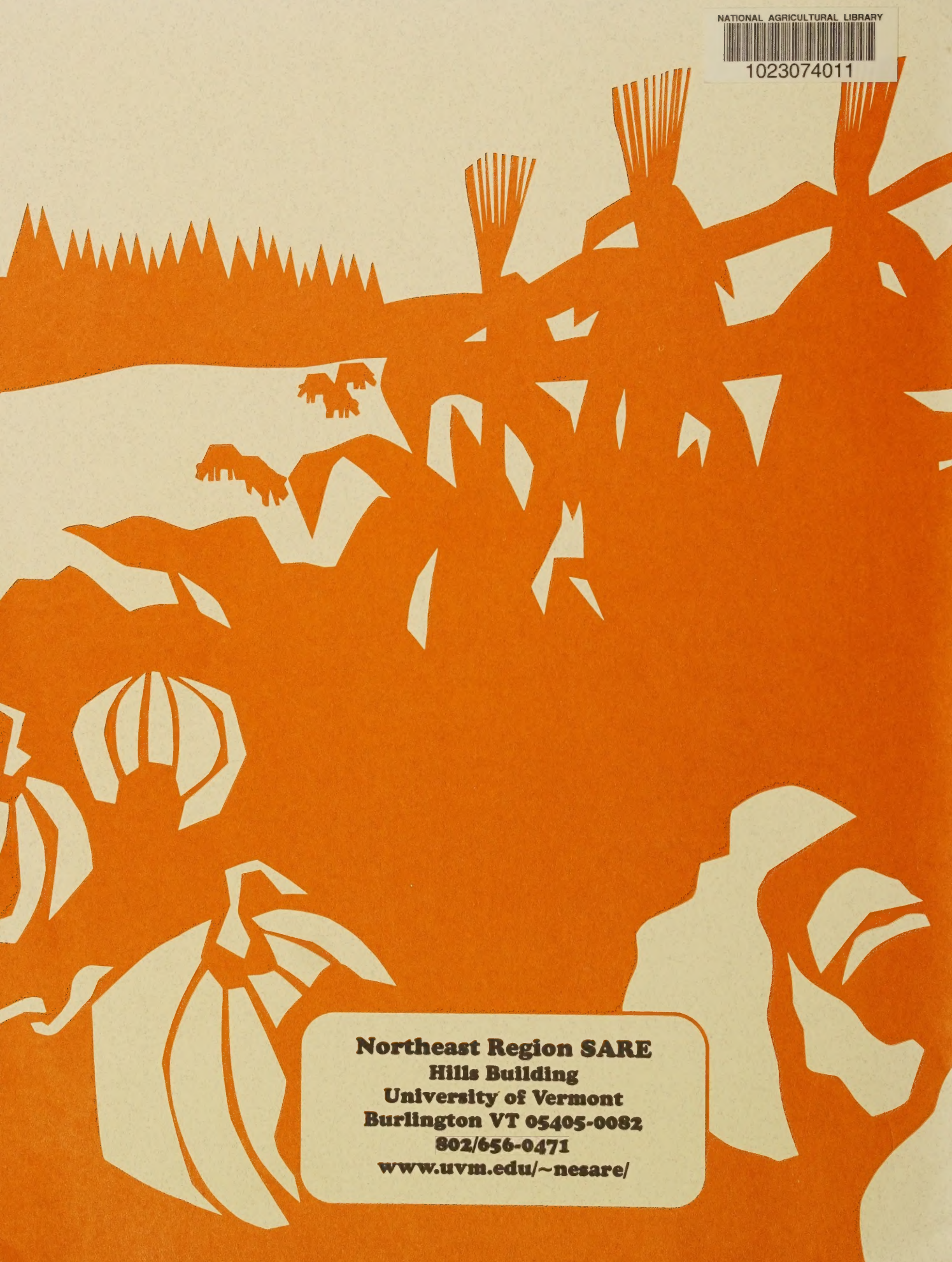


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